45055

PROPOSED
INTERIM MEASURES/INTERIM REMEDIAL ACTION
DECISION DOCUMENT FOR
THE ROCKY FLATS INDUSTRIAL AREA

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

March 1994

ENVIRONMENTAL RESTORATION PROGRAM

PROPOSED
INTERIM MEASURES/INTERIM REMEDIAL ACTION
DECISION DOCUMENT FOR
THE ROCKY FLATS INDUSTRIAL AREA

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

March 1994

ENVIRONMENTAL RESTORATION PROGRAM

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

SECTION **PAGE**

TABLE OF CONTENTS (CONTINUED)

SECTION PAGE

TABLE OF CONTENTS (CONTINUED)

SECTION PAGE

TABLE OF CONTENTS (CONTINUED)

SECTION PAGE

TABLE OF CONTENTS (CONTINUED)

SECTION **PAGE**

SECTION PAGE

TABLE OF CONTENTS (CONTINUED)

SECTION PAGE

SECTION PAGE

TABLE OF CONTENTS (CONTINUED)

SECTION PAGE

SECTION PAGE

SECTION PAGE

LIST OF FIGURES

SECTION PAGE

SECTION PAGE

TABLE OF CONTENTS (CONTINUED)

SECTION PAGE

LIST OF TABLES

TABLE OF CONTENTS (CONTINUED)

SECTION PAGE

SECTION PAGE

LIST OF APPENDICES

LIST OF PLATES

LIST OF ACRONYMS AND ABBREVIATIONS

ACE	Activity Control Envelopes
AEC	U.S. Atomic Energy Commission
AIP	Agreement in Principle
Am	americium
APENs	Air Pollution Emission Notices
AQD	Air Quality Division
AQMP	Air Quality Management Plan
ARAC	atmospheric release advisory capability
ARARs	Applicable or Relevant and Appropriate Requirements
ASI	Advanced Sciences, Inc.
bgs	below ground surface
BMP	Best Management Practice
BOD5	5-Day Biological Oxygen Demand
BS	building sump
BTOC	below top of casing
C_2H_3Cl	vinyl chloride
CAA	Clean Air Act
CAM	Continuous Air Monitor
CB	catch basin
CCl_4	carbon tetrachloride
CDH	Colorado Department of Health
CDIW	Control and Disposition of Incidental Waters
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHWR	Colorado Hazardous Waste Regulations
Ci	curies
CI	cast iron
Cl	chlorine
CLP	Contract Laboratory Program
cm/sec	centimeters per second
CMI	Corrective Measures Implementation
CMP	corrugated metal pipe
CMS	Corrective Measures Study
CNNMF	Consolidated Non-Nuclear Manufacturing Facility
COI	compounds of interest
ComRad	Community Radiation Monitoring Program
COPC	constituents of potential concern
CPFM	Colloid Polishing Filter Method
cpm	counts per minute
Cr	chromium
Cs	cesium
CTCS	Chemical Tracking and Control System

LIST OF ACRONYMS AND ABBREVIATIONS

CWA	Clean Water Act
D&D	Decontamination and Decommissioning
DAC	derived air concentration
DCG	derived concentration guide
DD	Decision Document
DGO	data gathering objectives
DIP	ductile iron pipe
DIS	Drain Identification Study
DNAPL	dense nonaqueous-phase liquid
DOE	U.S. Department of Energy
DRCOG	Denver Regional Council of Governments
EAF	Emergency Assessment Facility
EDE	effective dose equivalent
EM	Environmental Management
EMAD	Environmental Monitoring and Analysis Division
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPLAN	RFP Emergency Plan
EPM	Environmental Protection Management
EPMP	Environmental Protection Management Plan
EPOS	Emergency Preparedness Offsite Systems
ER	Environmental Restoration
ERD	Environmental Restoration Division
ERDA	Energy Research and Development Administration
ERTSD	Environmental Restoration Technical Support Document
FD	foundation drain
FDM	Fugitive Dust Model
FFCA	Federal Facility Compliance Agreement
FFE	finished floor elevation
Fm	Formation
FRERP	Federal Radiological Emergency Response Plan
FRMAP	Federal Radiological Monitoring and Assessment Plan
FS	feasibility study
ft/ft	feet per foot
ft/day	feet per day
FTIR	Fourier-transform infrared system
FY	fiscal year
GAC	granular activated carbon
GFAA	graphite furnace atomic absorption
gpm	gallons per minute
GPMP	Groundwater Protection and Monitoring Program
GRRASP	General Radiochemistry and Routine Analytical Services Protocol

LIST OF ACRONYMS AND ABBREVIATIONS

HEAST	Health Effects Assessment Summary Tables
HEPA	high efficiency particulate air
HF	hyperfiltration
HRR	Historical Release Report
IAG	Interagency Agreement
IE	ion exchange
IHSS	Individual Hazardous Substance Site
IM	Interim Measures
INPUFF	Integrated PUFF
IRA	Interim Remedial Action
IRIS	Integrated Risk Information System
ISC	Industrial Source Complex
ITPH	Interceptor Trench Pump House
ITS	interceptor trench system
IWCP	integrated work control program
Jacobs	Jacobs Engineering Group Inc.
Jeffco	Jefferson County
km	kilometer
LANL	Los Alamos National Laboratory
LDR	Land Disposal Restrictions
LEL	lower explosive limit
MEMS	multiple-effect multiple-stage
mg/L	milligrams per liter
MH	manhole
MINIRAM	Miniature Real-Time Aerosol Monitor
ml	milliliter
MOC	materials of concern
mph	miles per hour
mrem/yr	millirem per year
MSDS	Material Safety Data Sheet
NAAQS	National Ambient Air Quality Standards
NBS	National Bureau of Standards
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
NVSS	nonvolatile suspended solids
OPWL	original process waste lines
OSA	Operational Safety Analysis
OU	operable unit
OVA	organic vapor analyzer
PAS	perforated asbestos subdrain
PC	porous concrete

LIST OF ACRONYMS AND ABBREVIATIONS

PCB	polychlorinated biphenyl
PCE	tetrachloroethene
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PEIS	Programmatic Environmental Impact Statement
PM-10	particulate matter less than 10 micrometers in diameter
ppb	parts per billion
PPCD	Plan for the Prevention of Contaminant Dispersion
ppm	parts per million
PSA	permitted storage area
PST	permitted storage tank
PTA	permitted treatment area
Pu	plutonium
PVC	polyvinyl chloride
PW	process waste
QA	quality assurance
R&D	research and development
RAAMP	Radiological Ambient Air Monitoring Program
RCP	reinforced concrete pipe
RCRA	Resource Conservation and Recovery Act
REAP	Real-Time Environmental Applications Product
RFEDS	Rocky Flats Environmental Database System
RFI	RCRA facility investigation
RFO	Rocky Flats Office
RFP	Rocky Flats Plant
RI	remedial investigation
RO	reverse osmosis
Rockwell	Rockwell International
ROD	Record of Decision
SAAM	Selective Alpha Air Monitor
SAIC	Science Applications International Corporation
SAR	Safety Analysis Reports
SARA	Superfund Amendments and Reauthorization Act
SCA	satellite collection area
SD	storm drain
SEA	systems engineering analysis
SEP	solar evaporation pond
SID	South Interceptor Ditch
SNM	special nuclear material
SOP	Standard Operating Procedure
SS	sanitary sewer
STL	steel
STP	Sewage Treatment Plant

LIST OF ACRONYMS AND ABBREVIATIONS

SVOC	semivolatile organic compound
SW	surface water sample point
TAL	Target Analyte List
TCE	trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
THM	trihalomethane
TIC	tentatively identified compound
TLLA	total long-lived alpha
TLLB	total long-lived beta
TMST	temporary modular storage tank
TRAC	Terrain-Responsive Atmospheric Code
TRC	total residual chlorine
TSCA	Toxic Substances Control Act
TSIP	Transition Standards Identification Program
TSP	total suspended particulate
TSS	total suspended solids
TTO	Total Toxic Organics
U	uranium
UBC	under-building contamination
UCNI	Unclassified Controlled Nuclear Information
UF	ultrafiltration
UMTRA	Uranium Mill Tailings Remedial Action
USGS	U.S. Geological Survey
USQ	unreviewed safety question determination
UTL	upper tolerance limit
UV	ultraviolet
VAX®	Virtual Address Extension
VC	vapor compression
VCP	vitrified clay pipe
VOA	volatile organic analytes
VOC	volatile organic compound
VSS	vital safety systems
WBS	Work Breakdown Structure
WEMS	Waste and Environmental Management System
WET	whole effluent toxicity
WSRIC	Waste Stream Residue Identification and Characterization
WWTUE	Waste Water Treatment Unit Exclusion
YSI	Yellow Springs Instruments
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCA	1,2-dichloroethane

LIST OF ACRONYMS AND ABBREVIATIONS

1,2-DCE	1,2-dichloroethene
°C	degrees Celsius
°F	degrees Fahrenheit
μCi	microcuries
μg/L	micrograms per liter
μg/mL	micrograms per milliliter
$\mu g/m^3$	micrograms per cubic meter
μm	micrometer
μmhos/cm	micromhos per centimeter

EXECUTIVE SUMMARY

The Interim Measure/Interim Remedial Action/Decision Document (IM/IRA/DD) for the Industrial Area at Rocky Flats Plant (RFP) was prepared in accordance with the RFP Interagency Agreement (IAG), dated January 22, 1991, and applicable regulatory guidance documents. U.S. Environmental Protection Agency (EPA) and Colorado Department of Health comments that were provided throughout its development have been incorporated into this IM/IRA/DD.

The change in the RFP mission from nuclear weapons production to environmental restoration has provided a tremendous opportunity to reevaluate several monitoring programs currently in place at RFP and begin the process of their evolution to address future requirements relative to the new mission. This proactive approach is intended to facilitate current and future environmental monitoring programs for all media at RFP. These monitoring programs, in conjunction with emergency response procedures, work control procedures, and employee awareness, will provide a comprehensive interim protection system for the Industrial Area. This system is designed to protect the public and the environment throughout transition and Decontamination and Decommissioning (D&D) activities.

The IM/IRA process is used at Rocky Flats to rapidly complete remedial actions by reducing or eliminating a potential threat to human health and the environment. The term IM/IRA is a combination of the terminology used for environmental investigation and for cleanup programs: Resource Conservation and Recovery Act (RCRA) IMs and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) IRA. The IM/IRA concept combines both CERCLA and RCRA objectives and is used at RFP to reduce potential risks by instituting measures to stabilize contamination or prevent potential contamination from leaving the Industrial Area.

The IM/IRA/DD provides a management approach to enhance the existing water management programs for waters collected and contained in building foundation drains,

basements, and sumps (incidental waters). Overall management of the incidental waters includes (1) defining incidental water sources, (2) defining drainage pathways, (3) characterization of water quality and flow, and (4) onsite treatment capabilities and practices. Improvements to the incidental water management programs are consistent with anticipated regulatory compliance programs in the Industrial Area.

The following major elements are detailed in this IM/IRA/DD:

- A methodology that references existing chemical tracking databases is presented to determine constituents of potential concern and compounds of interest for environmental monitoring.

- A conceptual risk-based approach that reduces large lists of potential constituents of concern to a smaller listing is provided. This reduced list results in a smaller analyte list that is more cost effective for environmental monitoring purposes.

- Potential groundwater migration pathways in the Industrial Area were assessed by creating potentiometric maps for the 1992 spring and winter seasons. The effect of building foundations and footing drains on alluvial groundwater flow was assessed.

- Groundwater monitoring well locations are proposed based on potential source area locations, potential groundwater migration pathways, and newly acquired monitoring data results for the Industrial Area.

- Surface water monitoring in areas of concern, which previously focused on the terminal ponds (in the buffer zone), will be expanded to include the Industrial Area.

- Surface water quality and hydraulic flow conditions will be studied in the Industrial Area to establish base-line conditions and locate potential source areas.

- Foundation drain monitoring and characterization will be expanded by increasing the number of chemical analytes and monitoring frequency, and by better defining hydraulic flow conditions. The characterization data are critical to the design of future onsite treatment upgrades and to the disposition of incidental waters potentially containing diverse ranges of contaminants.

- Incidental water management practices will use three disposition approaches: (1) direct discharge to the storm water system, (2) discharge to the sanitary sewer system and (3) onsite containment and treatment. Disposition approaches are dependent on incidental water flow and water quality characteristics.

- Volatile organic compounds will be added to the list of chemical analytes routinely analyzed within the Industrial Area for the air monitoring program.

- Monitoring systems for air and surface water use state-of-the-art technologies to accomplish plant transition monitoring objectives. Technical improvements for building D&D activities will be reviewed regularly to improve air and surface water monitoring capabilities.

- A building D&D conceptual monitoring plan is developed that institutes a two-tier approach: (1) onsite monitoring near the source, and (2) verification monitoring further from the D&D source to detect releases of potential contaminants before they leave the Industrial Area.

- A link is established between the D&D monitoring activities (site monitoring and verification monitoring) and the RFP Emergency Response Program.

- The concept of developing base-line concentrations for all media near an area undergoing D&D is presented. Exceeding these base-line concentrations during D&D monitoring would indicate a problem in engineering controls (pathway protection procedures) or site monitoring activities.

Because this IM/IRA is designed to be proactive, the environmental monitoring systems at and within the Industrial Area were evaluated. In the past, environmental monitoring emphasized areas beyond the Industrial Area and into the buffer zone where the RFP property line has been the point of concern. The current RFP environmental monitoring programs reviewed and assessed for this IM/IRA/DD are extensive, well organized, and successful in meeting past environmental monitoring objectives. Data gaps noted in this decision document are not an indication of programmatic deficiencies but reflect gaps relative to anticipated future monitoring objectives. These objectives include providing a comprehensive Industrial Area protection plan.

1.0 INTRODUCTION

This document is the Interim Measures/Interim Remedial Action/Decision Document (IM/IRA/DD) for the Rocky Flats Plant (RFP) Industrial Area and was prepared in accordance with the Rocky Flats Interagency Agreement (IAG), dated January 22, 1991, and applicable regulatory guidance documents. Comments from the U.S. Environmental Protection Agency (EPA) and Colorado Department of Health (CDH) were incorporated throughout the development of this IM/IRA/DD.

This IM/IRA/DD is intended to facilitate the environmental monitoring programs at Rocky Flats based on the U.S. Department of Energy's (DOE) new mission for the Industrial Area. In addition, this document provides a plan to enhance the existing water management programs for waters collected and contained in building footing drains, basements, valve vaults, and sumps. Recommendations specified in the IM/IRA/DD will facilitate actions within the Industrial Area that will increase the capability of detecting potential spills or releases before they migrate beyond the Industrial Area boundary.

The IM/IRA process is used at Rocky Flats as a means to rapidly complete remedial actions by reducing or eliminating a potential threat to human health and the environment. The term IM/IRA is a combination of the terminology used for environmental investigation and cleanup programs: the Resource Conservation Recovery Act (RCRA) IM and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) IRA. CERCLA is designed as a response program to deal with contamination created by previous waste management practices. RCRA is a regulatory program for current and new sites to prevent industrial sites from becoming contaminated (Arbuckle, et al. 1989).

The main features that differentiate an interim action from a CERCLA Remedial Investigation/Feasibility Study (RI/FS) or a RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) are (1) a limited number of alternatives are evaluated; (2)

a complete base-line risk assessment is not required; and (3) documentation requirements are minimized (Morrison Knudsen Corporation 1993).

The IM/IRA concept is used at Rocky Flats to reduce potential risks at a site by instituting temporary measures to stabilize the site or prevent further or potential contamination from leaving the site. The IM/IRA/DD must be followed by, and be compatible with, a Record of Decision (ROD) that will (1) provide long-term protection of human health and the environment, (2) fully address the principal threats posed by the site, and (3) address the statutory preference for treatment that reduces toxicity, mobility, or volume of wastes (EPA 1991).

The interim actions selected in this IM/IRA/DD are protective of human health and the environment. Because this IM/IRA/DD does not constitute the final remedy for the Industrial Area, the statutory preference for remedies that use treatment options that reduce toxicity, mobility, or volume as the principal element, will be addressed by the final response action. Because this is an IM/IRA/DD, the review of monitoring programs and the management and treatment of incidental waters will be ongoing.

1.1 MISSION OF THE ROCKY FLATS PLANT

The mission of RFP has changed in recent years to the following activities: (1) performing environmental restoration and waste management activities and (2) developing plans for the transition of various facilities to other uses or for decontamination and decommissioning (D&D).

On January 28, 1992, President Bush announced that the W-88 warheads would no longer be produced for the Trident submarines. Because the production of the W-88 nuclear weapon triggers was the only remaining plutonium production assignment for RFP, the plant's mission was changed. On March 14, 1992, Secretary of Energy James Watkins announced that the Rocky Flats mission would change from nuclear weapons

production to environmental restoration and waste management. The objective behind these environmental restoration programs would be for eventual D&D of the Rocky Flats site. Although environmental restoration is the primary mission, RFP will be required to maintain a specified number of buildings in a state of production readiness to be used for interim plutonium processing and storage for future nuclear weapon needs. The plant must be capable of producing weapon components within three years (Colorado Council on Rocky Flats 1993).

The move from weapons production to environmental restoration will be made possible through the building transition and D&D processes. The transition begins when the use of a building is no longer needed for production or chemical material storage. The building will undergo an initial characterization for hazard assessment and planning purposes. Then, the stored chemicals and salvageable machinery will be removed. The D&D phase will involve decontaminating and cleaning of buildings, followed by more intensive building characterization. The fate of the building will be based on future use and degree of contamination.

1.2 INTERIM MEASURES/INTERIM REMEDIAL ACTION OBJECTIVES

This decision document presents a program that proactively addresses the current and future monitoring requirements for the Rocky Flats Industrial Area. The objective is to maintain a safety net around the Industrial Area to monitor for, protect against, and respond to potential contaminant releases until and during D&D. This safety net involves all of the plant protective systems that are in place for the safety and protection of the public and environment. These protective systems include environmental monitoring, emergency/spill response, work control, and employee awareness and training.

The major goals behind the development of this IM/IRA/DD are as follows:

1. Create a list of chemicals of concern and identify past and potential sources of contamination.

2. Define potential contaminant pathways.

3. Develop general conceptual site models for the Industrial Area encompassing current and future D&D conditions.

4. Define building foundation drain influence on groundwater migration.

5. Create a plan to enhance the current incidental water management plan for the Industrial Area.

6. Assess current onsite water treatment capabilities.

7. Assess current environmental monitoring programs' effectiveness relative to the Industrial Area boundaries and potential migration pathways.

8. Conceptualize verification monitoring and pathway protection procedures for D&D activities.

9. Review and assess new monitoring technologies for air and surface water media.

10. Provide programmatic linkage between D&D verification monitoring and the RFP Emergency Response Program.

11. Develop a general methodology to establish base-line conditions for areas undergoing D&D.

This safety net objective was accomplished through a systematic review of existing documentation and databases at RFP. From this review, a conceptual model was developed for the potential migration pathways of contaminants within the Industrial Area. Potential sources of contamination and chemicals of concern were identified. Potential source areas include fixed contamination in the facility, individual hazardous substance sites (IHSS), and potential releases from buildings that store chemicals or have waste storage areas. This document represents a plan to increase the capability of detecting potential releases at or within the boundaries of the Industrial Area during the current and future D&D activities at RFP.

1.3 SCOPE OF WORK

The development of this IM/IRA/DD involved an intensive review of existing monitoring information specific to the Industrial Area. The reviewed information was used to develop the document's historical site characterization, a description of historical waste practices, constituents of potential concern (COPC), and media-specific pathways. Based on the chemical source and pathways information, the current monitoring network within the Industrial Area was assessed in terms of spatial distribution, depth, frequency of sampling, and monitoring for the appropriate chemical parameters.

A potential contaminant pathway that is also addressed in this decision document involves the monitoring and management of incidental waters in the Industrial Area. Incidental waters are waters that accumulate in building basements, valve vaults, sumps, and foundation footing drains and have the potential for containing hazardous chemicals. This IM/IRA/DD addresses the influence of the foundation footing drains on the groundwater pathway and discusses the overall management of incidental waters from monitoring to disposition.

Because this IM/IRA is designed to be proactive in nature, the environmental monitoring systems at and within the boundaries of the Industrial Area were evaluated. In the past,

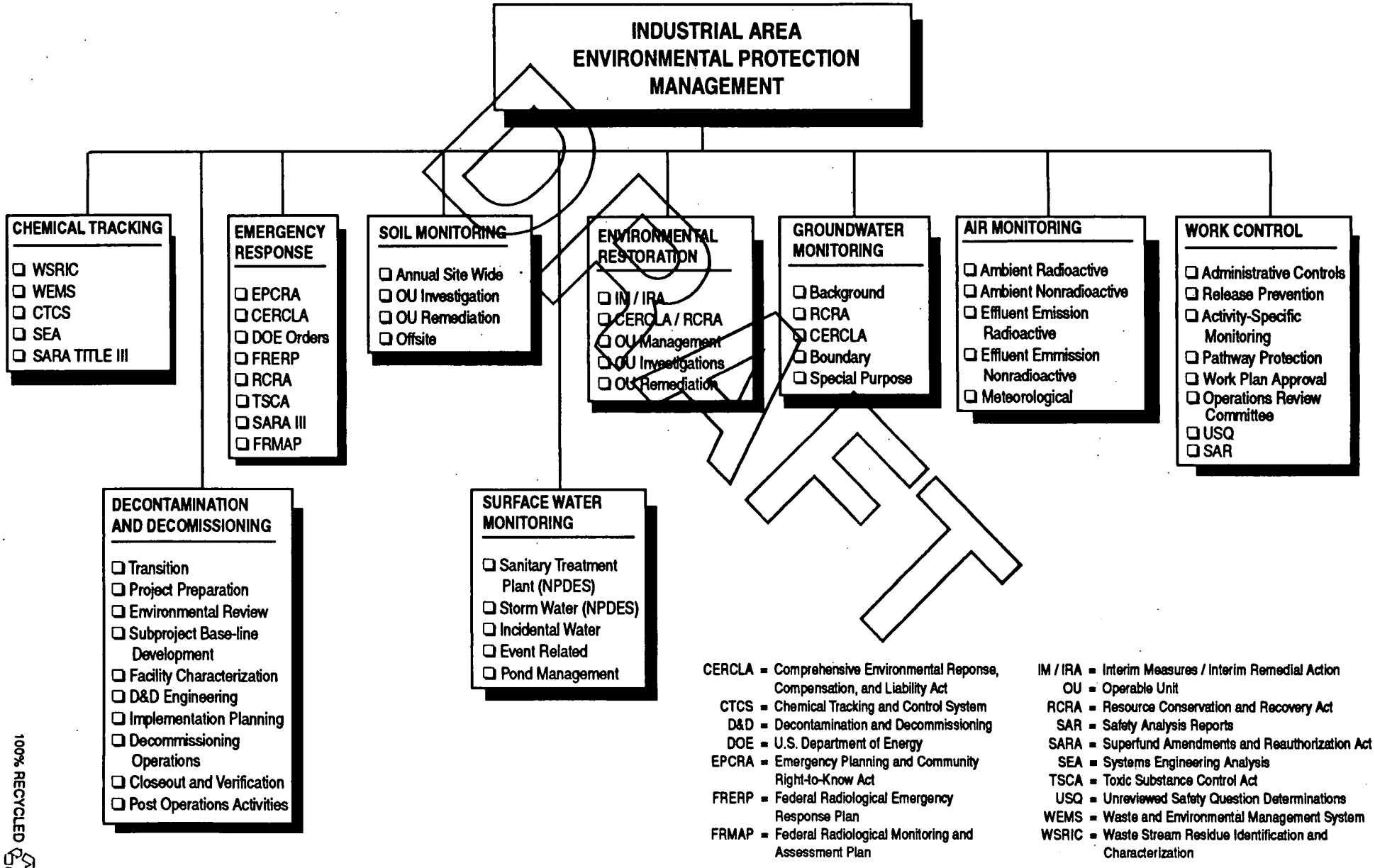
environmental monitoring has emphasized areas beyond the Industrial Area and into the buffer zone; the RFP property fence line has been the point of concern. This buffer zone emphasis is particularly true for surface water, where monitoring has been primarily concentrated in the buffer zone and associated with the water retention ponds. The current RFP environmental monitoring programs reviewed and assessed for this report are extensive, well organized, and successful in meeting the primary environmental monitoring objectives: environmental compliance and protection of human health and the environment (Figure 1-1). In an effort to be proactive, DOE has taken a more global approach to the site and is addressing the Industrial Area as a single source, or a collection of smaller source areas, which allows activities to be focused closer to the potential sources of contamination. This approach does not minimize the environmental monitoring in the buffer zone but merely focuses some activities on the pathways and release mechanisms from the potential source areas.

The scope of the Industrial Area IM/IRA includes assessing data gaps in the current monitoring programs relative to the Industrial Area safety net concept. A data gap refers to a monitoring area where environmental data are missing based on a defined monitoring objective. It is important to note that observed data gaps in this report do not constitute a failure or a problem with the existing RFP monitoring programs. These noted gaps reflect areas that require enhancement based on new monitoring objectives and approaches for the Industrial Area relative to the new mission for RFP.

1.4 PROJECT BACKGROUND

This IM/IRA/DD was developed by reviewing existing environmental monitoring program information for surface water, groundwater, air, incidental waters, and soils. Project personnel obtained information from all Industrial Area monitoring programs currently operating at RFP. This monitoring information was evaluated and recommendations were provided to develop an integrated and comprehensive monitoring

FIGURE 1-1
Industrial Area IM/IRA/DD
Summary of Environmental Protection Programs at Rocky Flats Industrial Area



CERCLA = Comprehensive Environmental Reponse, Compensation, and Liability Act
CTCS = Chemical Tracking and Control System
D&D = Decontamination and Decommissioning
DOE = U.S. Department of Energy
EPCRA = Emergency Planning and Community Right-to-Know Act
FRERP = Federal Radiological Emergency Response Plan
FRMAP = Federal Radiological Monitoring and Assessment Plan

IM / IRA = Interim Measures / Interim Remedial Action
OU = Operable Unit
RCRA = Resource Conservation and Recovery Act
SAR = Safety Analysis Reports
SARA = Superfund Amendments and Reauthorization Act
SEA = Systems Engineering Analysis
TSCA = Toxic Substance Control Act
USQ = Unreviewed Safety Question Determinations
WEMS = Waste and Environmental Management System
WSRIC = Waste Stream Residue Identification and Characterization

flats\fig1-1.fh3

program to address current and future monitoring objectives within the Industrial Area. Integration of the existing monitoring program information and the overall assessment of current and future monitoring program requirements was developed through six primary tasks:

- review of existing data;
- assessment of contaminants and sources;
- identification of media-specific pathways;
- assessment of current monitoring programs;
- assessment of future monitoring programs; and
- assessment of incidental water management and treatment programs.

1.4.1 Review of Existing Data

Data gathering objectives (DGO) were developed to provide an efficient means to acquire specific environmental information for the Industrial Area. The DGOs were specific for each environmental medium (groundwater, surface water, incidental waters, and air) and involved the following processes:

- stating and defining the problem/goal;
- defining the boundaries of the problem;
- defining inputs to solve the problem; and
- defining the technical approach to solve the problem.

This DGO approach led to a more focused search and review of existing RFP monitoring information needed to meet the overall project objectives.

1.4.2 Assessment of Contaminants and Sources

Determining which chemicals should be monitored within the Industrial Area was critical to assessing the current monitoring programs. This task involved referencing and developing chemical listings (databases) that were determined to be chemicals that have historically been released or have the potential of reaching the Industrial Area environment. The COPCs were developed from chemicals identified from past spills or releases at IHSSs. Compounds of interest (COI) were developed by reviewing and assessing EG&G's current chemical tracking and inventory databases of chemicals and wastes currently being stored in the Industrial Area.

1.4.3 Identification of Media-Specific Pathways

Potential contaminant transport pathways and mechanisms were reviewed or developed to assess the current monitoring system's capability to detect contamination before leaving the Industrial Area. Generally, the surface water pathways were determined by topographical maps and previous drainage studies conducted in the Industrial Area. Groundwater pathways were determined by developing potentiometric flow maps based on historical groundwater elevation data and assessing the impact on groundwater migration as a result of building foundation drains. Incidental water pathways were determined by reviewing existing engineering drawings of building drains, and storm and sanitary sewer system piping. The air pathway was assessed by reviewing historical meteorological conditions and air dispersion modeling studies performed at RFP. Based on all the pathway information, a general Industrial Area conceptual site model was constructed.

1.4.4 Assessment of Current Monitoring Programs

Based on the identification of contaminant pathways and COPCs and COIs, the existing Industrial Area monitoring programs could be evaluated on their ability to detect

contamination before leaving the Industrial Area. The evaluation involved spatial distribution of monitoring locations, locations relative to contaminant pathways, monitoring frequency, and adequacy of analytical testing parameters based on the COPCs and COIs.

The current monitoring systems were also assessed on the basis of detecting contamination before leaving the Industrial Area during future D&D activities. Five main activities were associated with assessing the monitoring systems for D&D activities:

1. Conceptualize a verification monitoring program for D&D activities that would complement site-specific monitoring activities and engineering controls to ultimately detect contamination before leaving the Industrial Area.

2. Develop general recommendations for pathway protection procedures that could be implemented at the site that is undergoing D&D activities to reduce the potential of contaminants entering the environment.

3. Review new monitoring technologies for surface water and air that could be used during D&D activities and to enhance the existing monitoring network.

4. Review the current emergency response program linkage to existing monitoring programs and to D&D activities.

5. Conceptualize a general methodology for establishing base-line concentrations for each medium in the Industrial Area associated with D&D activities. Contaminant concentrations exceeding these base-line concentrations would indicate potential problems with the pathway protection procedures or the site-specific monitoring for D&D activities and would prompt an investigation and response.

1.4.5 Assessment of Incidental Waters Management and Treatment Programs

The assessment of the existing incidental waters program included a review of building foundation drain and outfall locations, water sampling locations, analytical testing parameters, and flow volume information. As part of this assessment, the disposition practices of incidental waters and the current onsite water treatment capabilities were evaluated, and program enhancements were recommended. The objective of this task was to provide program enhancements to the existing incidental waters management program that would complement current onsite regulatory programs.

1.5 INTERIM MEASURES/INTERIM REMEDIAL ACTION/DECISION DOCUMENT ORGANIZATION

The IM/IRA/DD is composed of the following 12 sections:

- Section 1.0, Introduction;
- Section 2.0, Site History and Characterization;
- Section 3.0, Constituents of Potential Concern, Compounds of Interest, and Sources;
- Section 4.0, Groundwater Monitoring;
- Section 5.0, Surface Water Monitoring;
- Section 6.0, Air Monitoring;
- Section 7.0, Incidental and Footing Drain Waters;

- Section 8.0, Conceptual Site Model;
- Section 9.0, Decontamination and Decommissioning Activities Monitoring Recommendations;
- Section 10.0, Future Conceptual Site Model;
- Section 11.0, Summary of Conclusions and Recommendations; and
- Section 12.0, References.

Sections 1.0 and 2.0 provide basic information on the background of the Industrial Area and the IM/IRA project. Sections 3.0 through 8.0 represent chemical information, assessments, and recommendations for the current conditions at RFP. These current transition monitoring programs in the Industrial Area are well established and the monitoring objectives well defined; the specific actions for D&D activities are very site-specific and not defined at this time. For this reason, the IM/IRA/DD separates the D&D activity monitoring recommendations (Section 9.0) from the current media-specific monitoring assessments. Therefore, the future site conceptual model (Section 10.0) provides a general discussion about contaminant pathways that may result from D&D activities and potential engineering controls.

2.0 SITE HISTORY AND CHARACTERIZATION

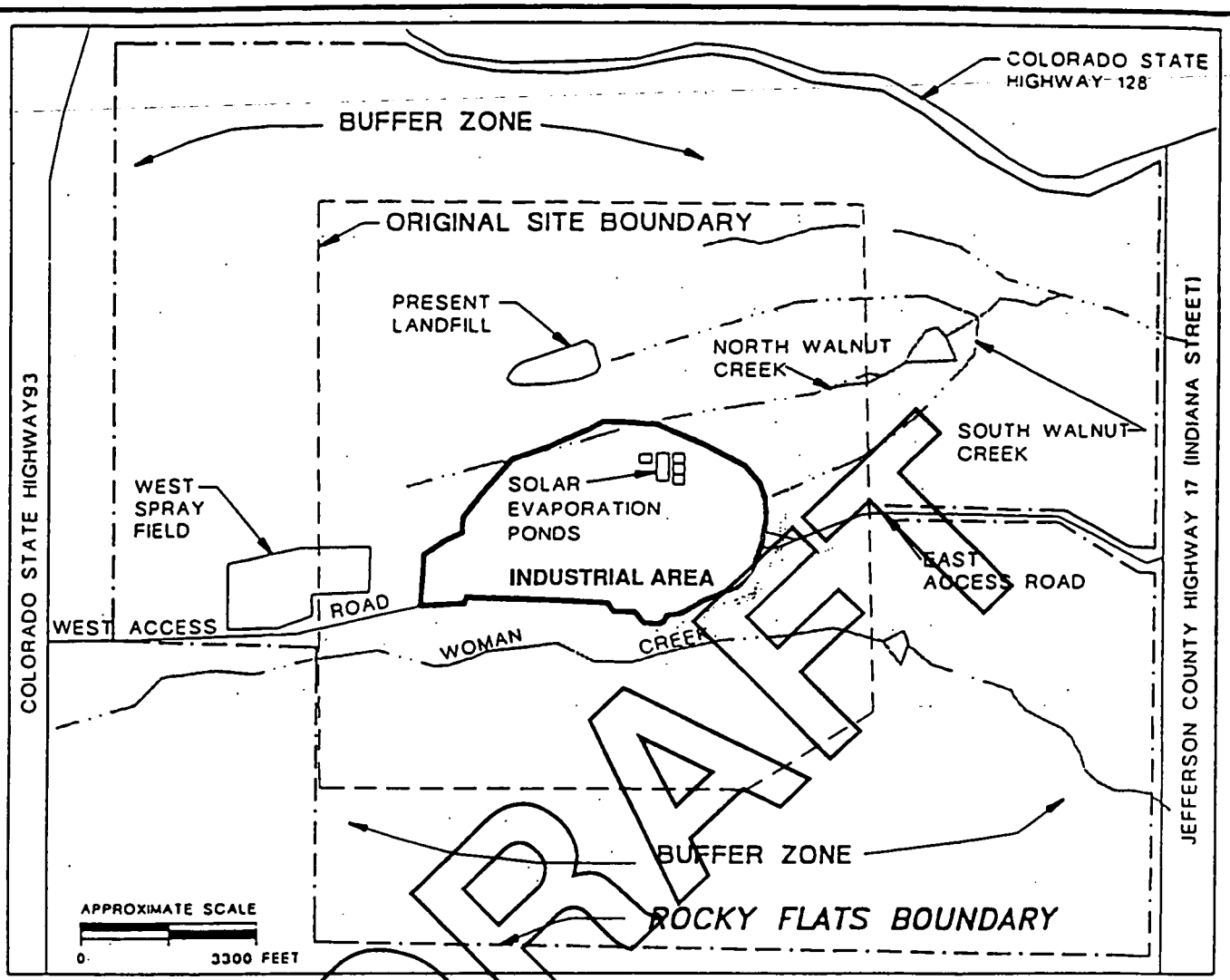
2.1 SITE DESCRIPTION

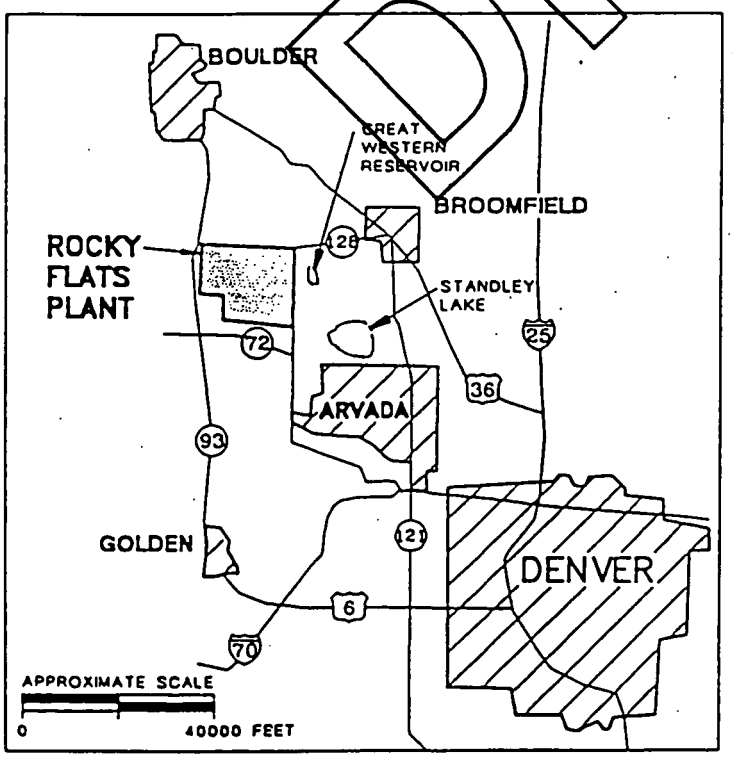
RFP is a government-owned and contractor-operated facility that was part of the nationwide nuclear weapons production complex. The primary mission of the RFP was to produce metal components for nuclear weapons. RFP is currently in transition from a defense production facility to one whose future mission includes environmental restoration, waste management, maintenance of a production contingency, and eventual D&D.

2.1.1 Location

RFP is located in northern Jefferson County (Jeffco), Colorado, approximately 16 miles northwest of Denver (Figure 2-1). Other surrounding cities include Boulder, Broomfield, and Arvada, all of which are located less than 10 miles to the northwest, east, and southeast, respectively. The RFP is bounded on the north by State Highway 128, on the east by Jeffco Highway 17 (Indiana Street), on the south by agricultural and industrial properties and State Highway 72, and on the west by State Highway 93.

The plant consists of approximately 6,550 acres of federally owned land in Sections 1 through 4 and 9 through 15 of Township 2 South, Range 70 West. The majority of buildings located within the RFP site are concentrated in a 384-acre zone called the Industrial Area or Controlled Area. The Industrial Area is surrounded by an essentially unoccupied buffer zone of approximately 6,150 acres (Figure 2-1).





PREPARED FOR:
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

FIGURE 2-1
Industrial Area IM/IRA/DD
Location of Rocky Flats Plant
Rocky Flats Plant

100% RECYCLED

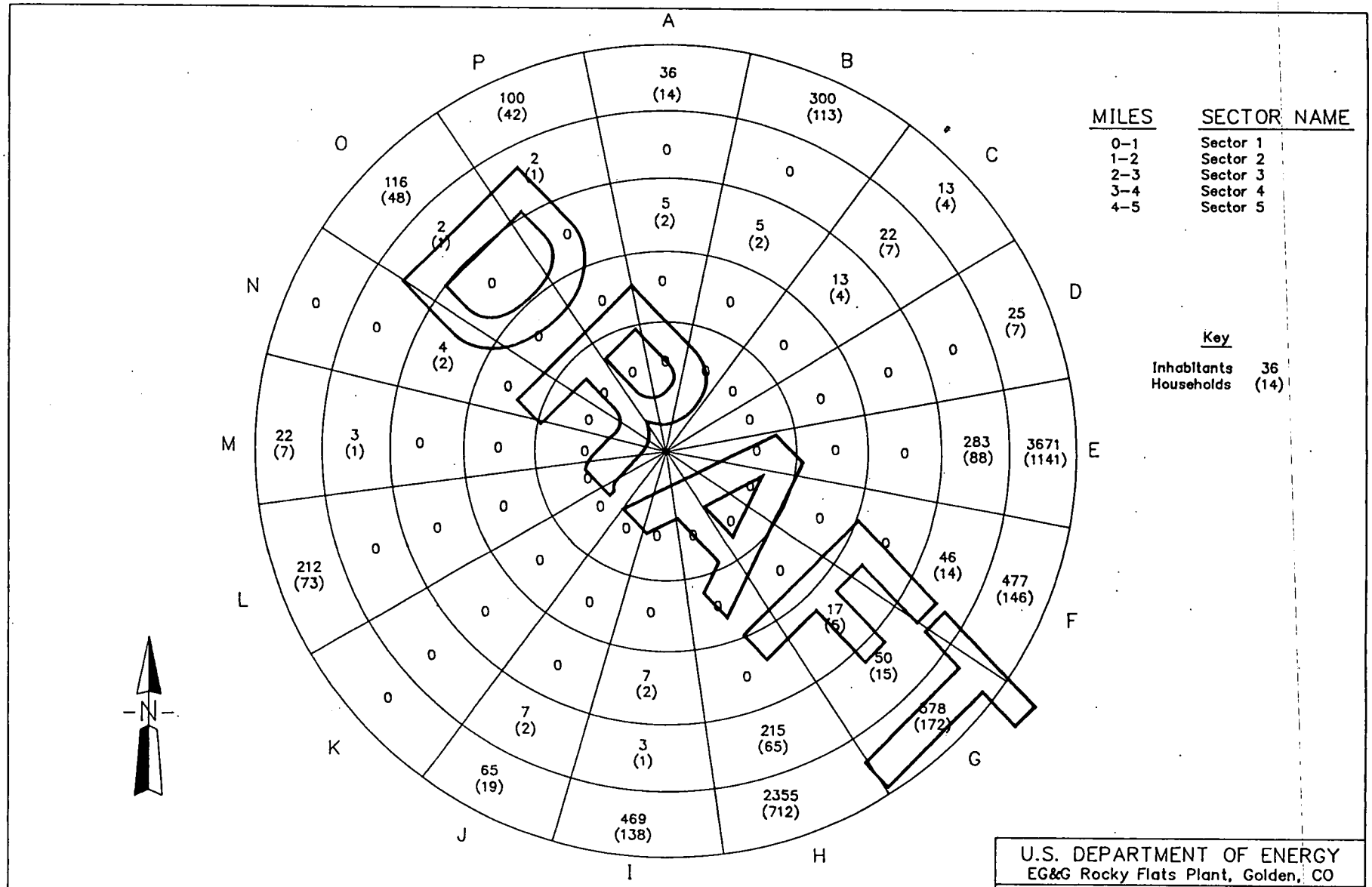
4953A90 02/10/92 3:55pm AWK

2.1.1.1 Surrounding Land Use and Population Density

The population, economics, and land use of areas surrounding RFP are described in a 1989 Rocky Flats vicinity demographics report prepared by DOE (DOE 1990). This report divides general use of areas within 0 to 5 miles of RFP into residential, commercial, industrial, parks and open spaces, agricultural and vacant, and institutional classifications and outlines current and future land use near the plant.

The majority of residential use within 5 miles (8 kilometers [km]) of RFP is located northeast, east, and south of the existing RFP. Figure 2-2 shows the 1989 population and residence distribution within a 5-mile radius from the center of RFP. Commercial development is concentrated near the residential developments around Standley Lake, primarily north and southwest, and around the Jeffco Airport, which is located approximately 3 miles (4.8 km) northeast of RFP. Active industrial land use within 5 miles (8 km) of the plant is limited to quarrying and mining operations located on land directly west and southwest of the RFP property.

Several areas of industrially zoned property are located around RFP, both directly adjacent and nearby. This property is not likely to be developed any time in the near future because of lack of water for fire protection. These properties must be accepted into a fire protection district to be developed for commercial or industrial use. To date, no fire protection district has been willing to accept the property, and it is anticipated that these properties will remain undeveloped in the near future. Open space land is located northeast of RFP near the City of Broomfield, and in small parcels adjoining major drainages and small neighborhood parks in the cities of Westminster and Arvada. Standley Lake is surrounded by Standley Lake Park. Irrigated and nonirrigated cropland, producing primarily wheat and barley, is located northeast of RFP near the cities of Broomfield, Lafayette, and Louisville; north of RFP near Louisville and Boulder; and in scattered parcels adjacent to the eastern boundary of the plant. Several horse operations and small hay fields are located south of RFP.



U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 2–2
INDUSTRIAL AREA IM/IRA/DD
1989 Population Distribution
Within 5 Miles of the
Rocky Flats Plant Site
(Based on DOE 1990)

\sw\swfig22.dwg 05H60300

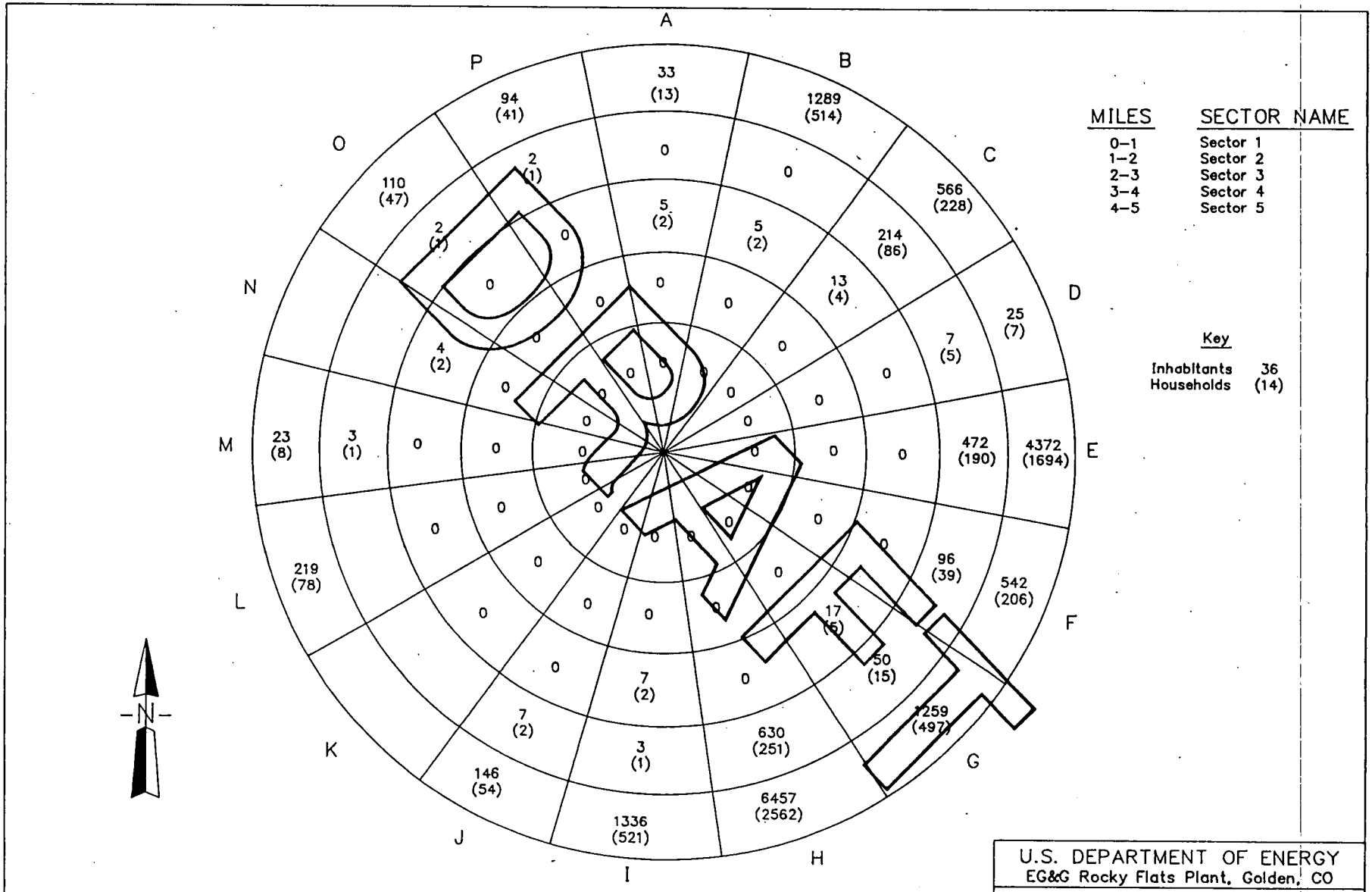
2.1.1.2 Future Population and Land-Use Projections

Future land use in the vicinity of RFP most likely will involve continued suburban expansion, increasing the density of residential, commercial, and industrial land use in the surrounding areas. The expected trend in population growth in the vicinity of RFP is addressed in the DOE demographics study (DOE 1990). This report considers expected variations in population density by comparing the 1989 setting to population projections for the years 2000 and 2010. DOE projections are based primarily on long-term population projections developed by the Denver Regional Council of Governments (DRCOG). Expected population density and distribution around RFP for the years 2000 and 2010 are shown in Figures 2-3 and 2-4, respectively. Table 2-1 summarizes the population data presented in Figures 2-2, 2-3, and 2-4. The rapid residential development of Rock Creek, in the town of Superior, north-northeast of RFP was not foreseen at the time of the 1989 report.

2.1.2 Description of Industrial Area

The Industrial Area, also known as the Controlled Area, is a 384-acre fenced security area, which contains the main production facilities. The main plant has 436 buildings, facilities, systems, and structures, of which 150 are permanent buildings and 90 are trailers used mainly for office space (DOE 1992a; EG&G 1992a). The remaining facilities are smaller structures, additional temporary structures, or parts of systems on the site. Each facility is numbered according to its function.

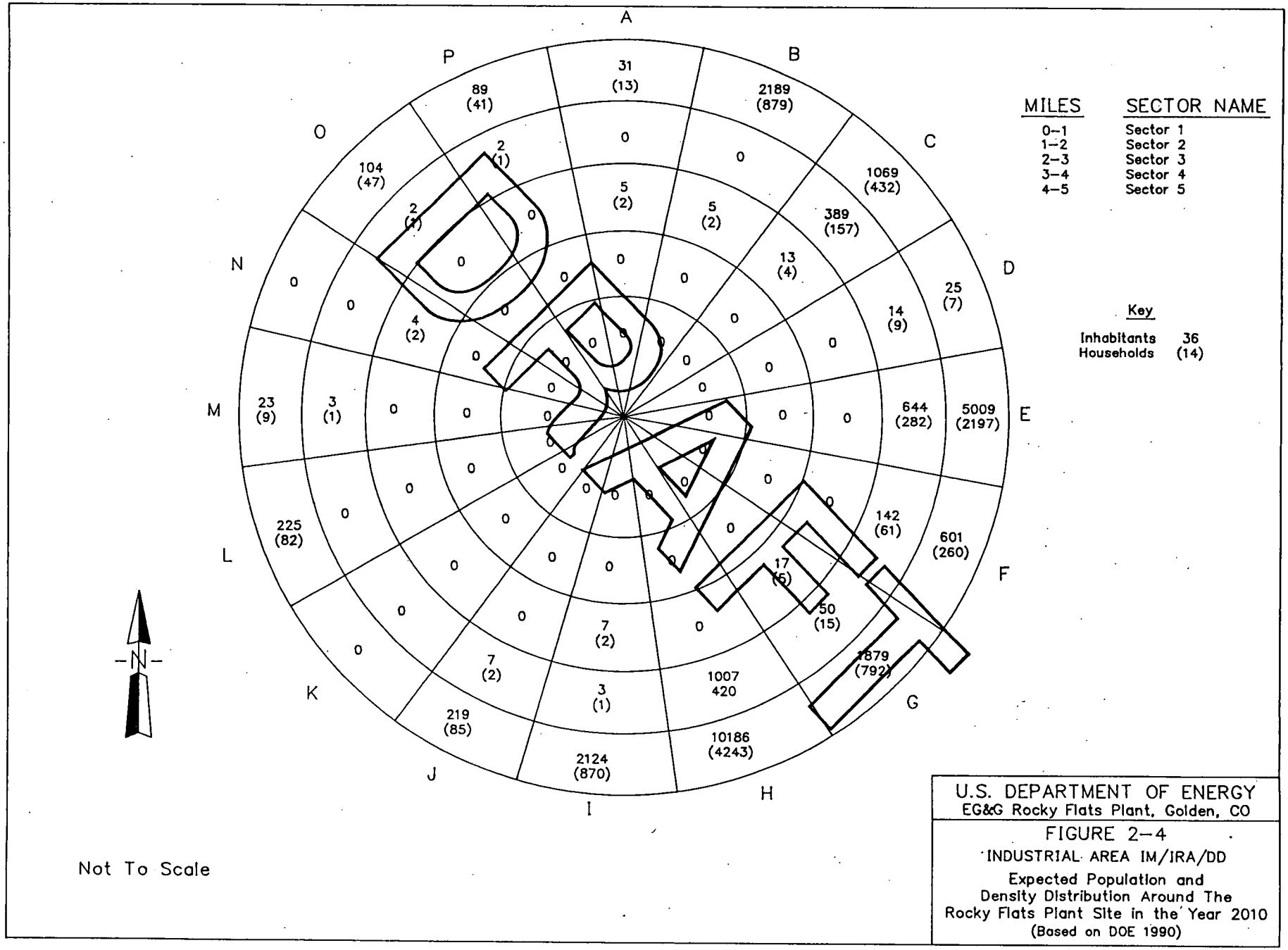
The industrial facilities are divided by Central Avenue into two main areas, as shown in Figure 2-5. The Protected Area, to the north, contains all of the facilities related to plutonium operations. Security fences and intrusion-detection systems surround all buildings in which plutonium is handled or stored, and various other measures are used to provide safeguards and security. The area to the south of Central Avenue contains



U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 2–3
INDUSTRIAL AREA IM/IRA/DD
Expected Population and Density Distribution Around The Rocky Flats Plant Site in the Year 2000 (Based on DOE 1990)

\sw\swfig23.dwg 05H60300



U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 2–4
INDUSTRIAL AREA IM/IRA/DD
Expected Population and
Density Distribution Around The
Rocky Flats Plant Site in the Year 2010
(Based on DOE 1990)

c:\rfiats\ew\ewfig24.dwg 05H60300

TABLE 2-1
Industrial Area IM/IRA/DD
Current and Projected Population in the Vicinity of the Rocky Flats Plant

Sector:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	SUM
Year: 1989																	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	5	5	13	0	0	0	17	0	7	0	0	0	0	4	0	0	51
4	0	00	22	0	283	46	50	215	3	7	0	0	3	0	2	2	633
5	36	300	13	25	3,671	477	578	2,355	469	65	0	0	22	0	116	10	8,439
SUM	41	305	48	25	3,954	523	645	2,570	479	72	0	212	25	4	118	10	9,123
Year: 2000																	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	5	5	13	0	0	0	17	0	7	0	0	0	0	4	0	0	51
4	0	0	214	7	472	96	50	630	3	7	0	0	3	0	2	2	1,486
5	33	1,289	566	25	4,372	542	1,259	6,457	1,336	146	0	219	23	0	110	94	16,471
SUM	38	1,294	793	32	4,844	638	1,326	7,087	1,346	153	0	219	26	4	112	96	18,008
Year: 2010																	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	5	5	13	0	0	0	17	0	7	0	0	0	0	4	0	0	51
4	0	0	389	14	644	142	50	1,007	3	7	0	0	3	0	2	2	2,263
5	31	2,189	1,069	25	5,009	601	1,879	10,186	2,124	219	0	225	23	0	104	89	23,773
SUM	36	2,194	1,471	39	5,653	743	1,946	11,193	2,134	226	0	225	26	4	106	91	26,087

Refer to Figures 2-2 through 2-4 for sector locations. Source: DOE 1990.

both nonplutonium manufacturing facilities, which are located in secured areas, and many of the general plant support facilities, some of which are in secured areas. Water treatment, utilities, and administration facilities are generally situated on the west end of Central Avenue, and waste treatment operations are near the east end.

2.1.3 History of Rocky Flats Plant

This section describes the history of plant operations, historical releases, and environmental monitoring at RFP.

2.1.3.1 Plant Operations

Construction of RFP was approved by the U.S. government in 1951. The purpose of the facility was to increase production of nuclear weapons components. Limited operations began in 1952 within a total site area of 2,520 acres and a plant facilities area of less than 400 acres. Early operations involved 700,000 square feet of building floor space in 20 structures.

From 1952 to 1989, operations at RFP consisted of fabrication of nuclear weapons components from plutonium, uranium, and nonradioactive metals (principally beryllium and stainless steel). Parts made at the plant were shipped elsewhere for assembly. In addition, the plant reprocessed components for recovery of plutonium after they were removed from obsolete weapons. Other activities at RFP have included research and development in metallurgy, machining, nondestructive testing, coatings, remote engineering, chemistry, and physics.

RFP was operated for the U.S. Atomic Energy Commission (AEC) from RFP's inception in 1951 until the AEC was dissolved in January 1975. At that time, responsibility for the RFP was assigned to the Energy Research and Development Administration (ERDA), which was succeeded by DOE in 1977. Dow Chemical USA, an operating unit of Dow Chemical Company, was the prime operating contractor of the facility from 1951 until

June 30, 1975. Rockwell International (Rockwell) succeeded Dow Chemical USA on July 1, 1975. EG&G Rocky Flats, Inc., succeeded Rockwell on January 1, 1990.

2.1.3.2 Historical Releases

The RFP weapons production operations generated nonhazardous, hazardous, radioactive, and mixed hazardous and radioactive waste streams (DOE 1987). Current waste handling practices involve both onsite and offsite recycling of hazardous materials and onsite storage of hazardous and radioactive mixed wastes, with the potential for offsite disposal of solid radioactive materials at another DOE facility. However, the RFP operating procedures historically included both onsite storage and disposal of hazardous, radioactive, and mixed wastes. Preliminary assessments under the Environmental Restoration (ER) Program have identified many of the past onsite accidental release sites and storage and disposal locations as potential sources of environmental contamination.

Hazardous substances that have been detected in the environment on the RFP as a result of plant operations include various radionuclides, nonradioactive metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and inorganic ions. These substances have been released to the environment through past waste management practices (e.g., outdoor storage or burial) and unplanned events such as leaks, spills, and fires. Herbicides that have been applied in the past at various locations on RFP have also been detected.

Site-Wide Events and Responses. The following general significant events have occurred at RFP that have potentially affected the environment of the entire plant site:

- A major facility expansion was initiated in 1955 and referred to as Part IV construction. The expansion provided RFP with greater process capabilities and many more buildings and facilities. When the buildings went into operation,

process liquid and solid waste were produced at a greater rate than before the expansion. Storage and disposal of the wastes became a major concern.

- In 1957, a fire occurred in Building 771, a plutonium recovery facility, that caused the air effluent plenum filters to be breached. In addition to airborne releases as a result of the fire, fire-fighting efforts and cleanup activities contributed to releases to the environment.

- A second major plant expansion, Part V construction, began in 1967, prompting increased manufacturing capabilities and waste-producing activities. Significant environmental cleanup efforts of waste produced during the 1950s and early 1960s were initiated at the same time.

- Storage of plutonium-contaminated cutting oils at the area now called the 903 Pad resulted in soil contamination through drum leakage. The last drums were removed in June 1968, and an asphalt cover over the drum storage area was completed in November 1969. Resuspension and wind dispersion of contaminated soil from outside the covered area is a major source of environmental releases at RFP.

- In 1969, a fire occurred in Building 776 and Building 777 that spread contamination into the buildings, the surrounding asphalt and soil, and the atmosphere. Subsequent cleanup activities produced a significant amount of fire wastes that were stored and/or disposed of at RFP.

- Following the 1969 fire, waste storage problems increased, and concerns were heightened regarding the potential for offsite releases via air, surface water, and groundwater. In addition to contamination cleanup activities, waste management procedures were altered to reduce potential for releases to the environment. Detention ponds in the drainages were upgraded, and additional controls were installed to monitor surface water before offsite discharge.

- In 1974, DOE purchased additional land surrounding the plant, which expanded the buffer zone and further isolated the Industrial Area from surrounding communities.

Individual Hazardous Substance Sites. The IAG was signed in January 1991 among CDH, EPA, and DOE. The agreement sets forth the regulations, requirements, and dates for achieving compliance with both CERCLA and RCRA environmental regulations. The IAG identified 117 IHSSs at RFP. These IHSSs, designated 101 through 217, were identified through a search of RFP records, employee interviews, and aerial photographic interpretation.

An IHSS is defined as a location associated with the threatened or actual release of hazardous substances that may cause harm to human health and the environment and includes sites where leaks, spills, or chemical storage may have occurred. The 117 numbered IHSSs include a total of 178 separate sites, and are grouped into 16 operable units (OU) for purposes of conducting field investigations and remediation activities. The Industrial Area contains OU4 (Solar Ponds), OU8 (700 Area), OU9 (Original Process Waste Lines [OPWL]), OU10 (Other Outside Closures), OU12 (400/800 Areas), OU13 (100 Area), OU14 (Radioactive Sites), OU15 (Inside Building Closures), and OU16 (Low Priority Sites). The OUs, associated IHSSs, and potential constituents of concern in the Industrial Area are discussed in greater detail in Section 3.0 of this report.

2.1.3.3 History of Environmental Monitoring

Since the inception of the RFP in 1951, routine monitoring has been conducted for potential RFP-derived contaminants in various environmental media. In addition to routine monitoring, numerous studies have been undertaken to characterize the RFP environment and to identify and characterize potential sites of environmental contamination at the RFP. These efforts have been driven by AEC, ERDA, and DOE policy, and by state and federal environmental regulations that have been promulgated

during the operating history of the RFP. Specific sampling and analysis programs for various media have evolved through the history of RFP operations.

Groundwater. Groundwater monitoring wells were installed at RFP as early as 1954 to monitor groundwater for radionuclides and other parameters. At least three wells were installed before 1960. In 1960, six monitoring wells were installed near the Solar Evaporation Ponds (SEP) to investigate leakage of water from the Solar Ponds. More wells were added in 1971 (six), 1974 (17), 1980 (10), 1981 (10), and 1982 (seven), resulting in a total of at least 59 wells installed by 1986. Wells in the RFP groundwater monitoring network were sampled annually until 1974, then semiannually until 1980 when sampling was increased to three times per year. Since 1982, monitoring wells have been sampled quarterly.

Groundwater samples have always been analyzed for radionuclides. More chemical parameters were added to the routine analyte list in 1974, 1979, and 1985. Beginning in 1985, additional analytes such as volatile organics, trace metals, and major ions were added to the sampling routine.

Seventy monitoring wells were installed in 1986 to (1) characterize facility-wide hydrogeology and groundwater quality at RFP and (2) satisfy the RCRA Subpart F requirements. An additional 67 wells were installed in 1987 to characterize groundwater quality and flow at various IHSSs and the three RCRA-regulated units (SEPs, West Spray Field, and Present Landfill.) No monitoring wells were installed in 1988. A total of 163 wells and piezometers were installed in 1989. Of these, 53 wells were installed for monitoring purposes at RCRA-regulated units, and approximately 50 piezometers were installed in the Industrial Area for the purpose of collecting water-level measurements for hydrogeologic characterization. Seventeen alluvial wells and piezometers were installed in 1990 for the purpose of background characterization and landfill siting. During 1991, 85 alluvial wells, 11 alluvial/bedrock wells, and 46 bedrock wells were installed, mostly in the Mound, East Trenches, and 881 Hillside areas. During 1992, 25

alluvial wells, one alluvial/bedrock well, and 12 bedrock wells were installed. An additional 42 wells were installed during 1993. All known (surveyed) existing and abandoned wells in the Industrial Area are shown in Figure 2-6.

Surface Water. Environmental monitoring of wastewater began in 1952 with measurement of total radiation. Water was only released if it met federal guidelines for radionuclides. During those initial years, monitoring information was not available to the public because of government policies related to nuclear weapons fabrication. Annual reports describing environmental activities were initiated in 1969 and were released to the public. In the early 1970s, RFP became the first federal weapons facility to release environmental information to the public through a monthly information exchange meeting with CDH, EPA, and participating cities. Until 1974, water quality regulation at the RFP was primarily conducted by DOE and predecessor agencies. In 1974, EPA issued the first National Pollutant Discharge Elimination System (NPDES) discharge permit for RFP, establishing external control of effluent concentration limits for contaminants. Monitoring and surface water management practices are in place to maintain discharge limits requested by CDH in the Agreement in Principle (AIP) signed by the State of Colorado and DOE in 1989. This agreement expanded previous arrangements called Memorandums of Understanding dating back to 1979, which gave CDH authority to sample and analyze water before offsite discharge.

Foundation drains have been identified for 20 buildings in the Industrial Area. Additionally, 71 utility pits exist (Hayes 1993). Apparently no records exist of historical monitoring of waters collected by these structures. Aperiodic sampling of foundation drains, primarily for radionuclides, dates to approximately 1977 (Hoffman 1981).

Air. Air monitoring programs at RFP started in the early 1950s and can be divided into two general programs: effluent emissions monitoring and ambient air monitoring.

Radiological monitoring of particulate effluent emissions from stacks and vents before July 1973 was focused on total long-lived alpha (TLLA) activity. From mid-1973 through 1977, particulate samples from plutonium exhaust ducts were collected weekly and analyzed for plutonium. Beginning in 1978, particulate samples from each exhaust system were composited into monthly samples for specific laboratory analysis of the plutonium, americium, and uranium isotopes following the TLLA determination.

Real-time detection and automatic alarms for abnormal emissions began in the mid-1960s with Selective Alpha Air Monitors (SAAM), formerly called Continuous Air Monitors (CAM). These monitors, located primarily in the plutonium facility air emission ventilation systems, were designed and constructed at RFP until the early 1970s when commercial models became available. At that point, RFP began using a RADēCO Model 441 alpha-detecting instrument. Since then, updated models have been added to the monitoring network, including RADēCO Models 442 and 442ARF.

A tritium sampling program began in the mid-1970s as the result of processing a shipment of plutonium during 1973 that, unknown to RFP personnel, had become contaminated with tritium at another facility. To prevent recurrence of such an incident, more stringent procedures were established to detect tritium and additional radionuclides in all incoming shipments and plant emissions.

Radiological monitoring of ambient air quality has been conducted in various forms since 1952. Early measurements were performed within the immediate vicinity of RFP using handheld devices measuring TLLA activity. Steady improvement in technology and expansions in the program to include a larger geographical area led to continuous sampling of particulates by high volume air samplers and radiochemical analysis of sample filters.

Nonradiological monitoring of ambient air began on a routine basis in 1981 with sampling for total suspended particulates (TSP). TSP is one of six criteria pollutants

listed under the original Clean Air Act (CAA). Sampling for PM-10 (particulate matter less than 10 micrometers [μm] in diameter) began in 1988 following the establishment of EPA PM-10 regulations in July 1987.

Soil. An annual soil monitoring program for radionuclides has been conducted since 1972, except between 1978 and 1983. Plutonium concentrations have been determined since 1972, and on selected samples, americium concentrations have been determined since 1988. Before that time, only plutonium concentrations were measured (EG&G 1991a; EG&G 1992b).

2.1.4 Future of Rocky Flats Plant

On September 27, 1991, the President of the United States announced the cancellation of several nuclear-weapons programs, leaving the Trident II missile as the only remaining system requiring fabrication of plutonium components at Rocky Flats. This requirement was eliminated in January 1992, when the President decided to cancel further production of the Trident II missile and its associated nuclear warhead, the W-88.

2.1.4.1 New Mission

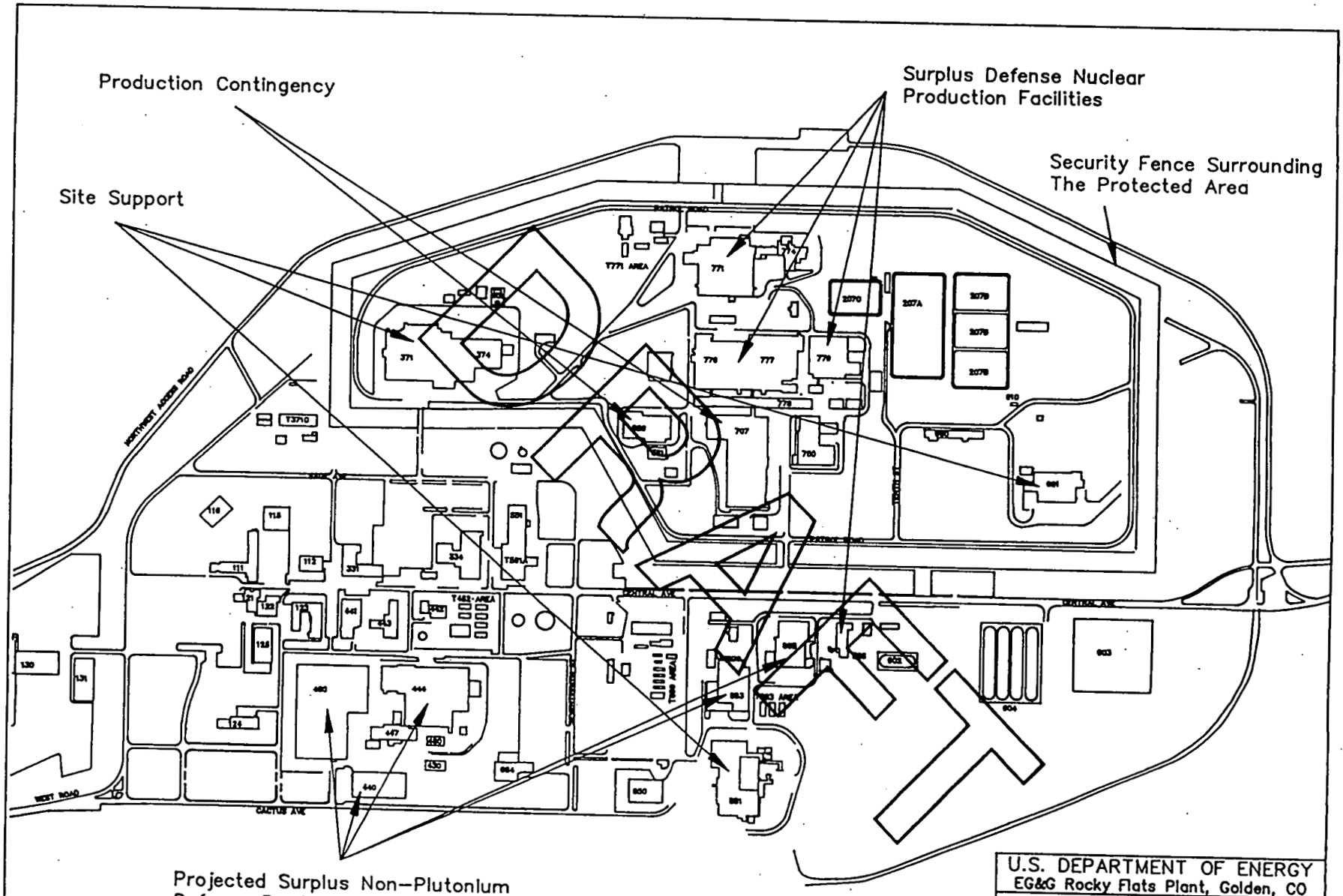
On February 10, 1992, the Secretary of Energy submitted a report to Congress from DOE regarding RFP. Various new missions were defined, including (1) cleaning out and stabilizing production process systems, (2) decontaminating obsolete and/or excess buildings and facilities, (3) processing plutonium residues in preparation for transport to storage/disposal sites, (4) possibly transferring nonplutonium manufacturing to other locations, (5) maintaining a contingency status in Building 707 pending final decisions from the reconfiguration Programmatic Environmental Impact Statement (PEIS), and (6) providing technical assistance in developing the design of a replacement facility to be evaluated in the PEIS.

2.1.4.2 Transition

The process of converting the RFP from the historical mission to the new mission, and the time it consumes, is known as "transition." The plant must change modes of operation, consolidate material, reduce risk, disassemble and reassemble organizationally, and both physically and conceptually convert to the new mission. Transition begins when an operating facility is formally declared surplus and ends when responsibility for the facility is formally turned over to the Office of Environmental Restoration and Waste Management. The end result of transition is the final disposition of the facility and its individual buildings, and conversion of the facilities for end use. Several alternatives are under consideration for the end use of the plant and its potential economic development.

Each facility on RFP is planned for eventual transition and/or D&D (EG&G 1992a). Nineteen structures contain the majority of special nuclear material (SNM), classified product and document inventories, hazardous chemical inventories, and radioactive and chemical contamination on the plant. The RFP facilities have been classified into five facility groups: (1) Surplus Defense Nuclear Production Facilities (Buildings 771, 776, 779, and 886); (2) Projected Surplus Non-Plutonium Defense Production Facilities (Buildings 439, 440, 444, 460, 865, and 883); (3) Waste and Environmental Facilities (Buildings 374, 664, and 774); (4) Site Support Facilities (Buildings 130, 131, 111, and 115; T115, 116, and 111 Trailers; 130 Trailers; Buildings 441, 452, 750, 850, 893, 119, 122, 123, 124, 125, 331, 333, 334, 443, 442, 790, 561, 778, 061, 551, 371, 881, and 991); and (5) Production Contingency Facilities (Buildings 707 and 559). Major buildings and facility groups are shown in Figure 2-7.

Transition for each building has been planned in phases. The initial phase is dependent on the building group. Surplus Defense Nuclear Production Facilities are currently in the Limited Operations Phase. Plutonium production operations are curtailed, and the ongoing activities in these facilities are essential to maintaining safety and safeguards



regulated systems. The Projected Surplus Non-Plutonium Defense Production Facilities will remain operational in the initial phase and will continue to complete manufacturing commitments for defense programs until Non-Nuclear Production is consolidated elsewhere.

The second phase, Waste Operations and Material Consolidation, includes initial facility characterization, SNM and classified matter consolidation, and the stabilization and removal of hazardous materials. The Deactivation Phase follows, during which facilities will be completely transitioned in accordance with Environmental Management (EM) Rocky Flats Plant criteria and standards. The final phase is Decontamination-Ready, a holding phase in which a building will be safely maintained until final decisions on its disposition are made.

2.1.4.3 Decontamination and Decommissioning

D&D activities will follow the transition phase. In general, D&D involves the removal and decontamination of fixed materials, equipment, facilities, and building structures that were not removed under the transition phase.

D&D activities may include removal of fixed equipment, piping, and tanks; retrofitting equipment; dismantling and removing ventilation systems; modifying or renovating buildings; dismantling or demolishing buildings; constructing buildings; and excavating underground or under-building contamination (UBC), equipment and structures.

2.2 PHYSICAL SETTING

Topography, surface water hydrology, regional geology, site geology, hydrogeology, climate and meteorology, and ecology are presented in this section.

2.2.1 Topography

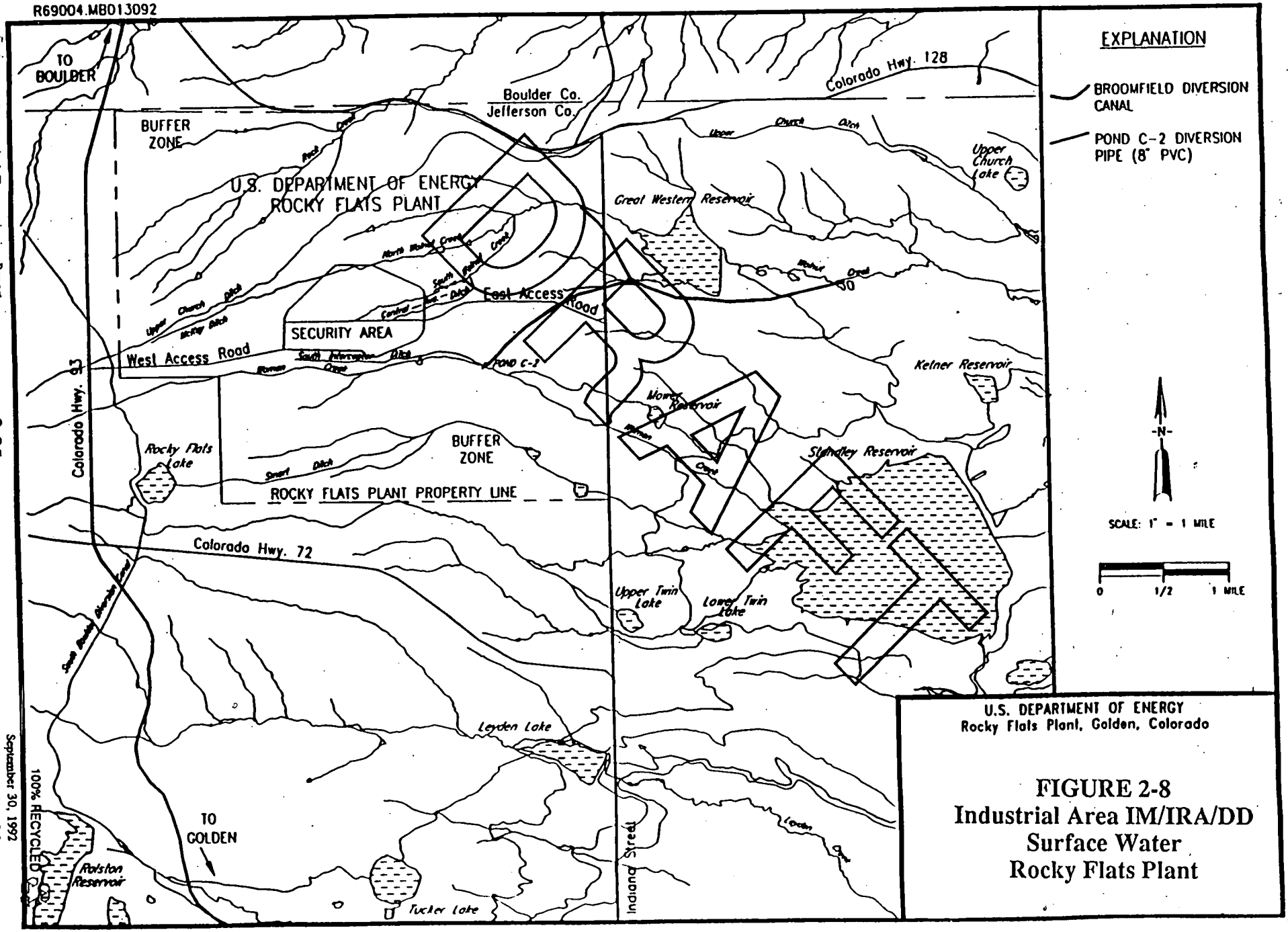
RFP is situated along the eastern edge of the southern Rocky Mountain region immediately east of the Colorado Front Range. RFP is located on a broad, eastward-sloping (approximately 1 degree) plain of coalescing alluvial fans, at an elevation of approximately 6,000 feet above mean sea level (msl). Locally, this plain originates near the mouth of Coal Creek Canyon, extends about 5 miles in an eastward direction, and terminates at a break in slope to low rolling hills. The alluvial surface is dissected by a series of east-northeast trending stream-cut valleys. The Industrial Area is located near the eastern edge of the fans on a terrace between the stream-cut valleys of North Walnut Creek on the north, and Woman Creek on the south.

2.2.2 Surface Water Hydrology

RFP is drained by three intermittent streams: Rock Creek, Walnut Creek, and Woman Creek (Figure 2-8). The northwestern corner of the plant is drained by Rock Creek, which flows northeast through the buffer zone to its offsite confluence with Coal Creek. Coal Creek flows into Boulder Creek, then St. Vrain Creek, and eventually, the South Platte River. No runoff from the Industrial Area drains into Rock Creek.

The northern part of the Industrial Area is drained by North and South Walnut creeks and an unnamed tributary. The three forks of Walnut Creek join in the buffer zone and flow toward Great Western Reservoir, which is approximately 1 mile east of the confluence. However, the Walnut Creek flow is generally rerouted around Great Western Reservoir into Big Dry Creek through the Broomfield Diversion Canal, which is operated by the City of Broomfield.

The Walnut Creek and Woman Creek drainages are separated by an east-west trending surface water divide (interfluve). Woman Creek originates to the west of the RFP,


R69004.MB013092
TO BOULDER
Boulder Co.
Jefferson Co.
Colorado Hwy. 128
BUFFER ZONE
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS PLANT
Upper Church Lake
Great Western Reservoir
East Access Road
SECURITY AREA
West Access Road
POND C-2
Kelner Reservoir
Mower Reservoir
Colorado Hwy. 93
Rocky Flats Lake
BUFFER ZONE
Standley Reservoir
ROCKY FLATS PLANT PROPERTY LINE
Colorado Hwy. 72
Upper Twin Lake
Lower Twin Lake
Leyden Lake
TO GOLDEN
Indiana Street
Ralston Reservoir
Tucker Lake
100% RECYCLED
EXPLANATION
BROOMFIELD DIVERSION CANAL
POND C-2 DIVERSION PIPE (8" PVC)
-N-
SCALE: 1" = 1 MILE
0
1/2
1 MILE
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado
FIGURE 2-8
Industrial Area IM/IRA/DD
Surface Water
Rocky Flats Plant

drains the southern part of the RFP buffer zone, and flows eastward into Pond C-1. The outflow from Pond C-1 flows offsite to the east, in part into Mower Reservoir and primarily into Standley Lake.

The South Interceptor Ditch (SID), located between the Industrial Area and Woman Creek, collects runoff from the southern part of RFP and ultimately diverts the water to Pond C-2. Waters from Pond C-2 are treated and monitored in accordance with the plant NPDES permit. Water from Pond C-2 that meets water quality requirements is transferred to the Broomfield Diversion Canal.

Eight other ditches convey water throughout the general RFP area: South Boulder Diversion Canal, Last Chance Ditch, Upper Church Ditch, McKay Ditch Bypass, Smart Ditch, Smart 2 Ditch, Mower Ditch, and Kinnear Ditch. The Upper Church Ditch, McKay Ditch Bypass, Kinnear Ditch, and Last Chance Ditch all divert water from Coal Creek to the east; the Smart Ditch diverts water from Rocky Flats Lake to the east; and the Smart 2 Ditch diverts water from the Smart Ditch to a Woman Creek tributary. The Mower Ditch diverts water from Woman Creek into Mower Reservoir. The South Boulder Diversion Canal is located west of the RFP and is unlined in the vicinity of the RFP, except for a cement-lined 100-meter aqueduct that crosses the Woman Creek drainage. Other ditches around the RFP are unlined and tend to lose water through seepage into the underlying subsurface materials.

In addition to the ditches described above, other surface-water management controls also are in operation at RFP. The West Interceptor Canal diverts runoff from the headwaters of North Walnut Creek via the McKay Ditch Bypass to Walnut Creek west of Indiana Street. In addition to ditches and canals, a series of detention ponds have been constructed to control the release of the RFP discharges and to collect surface runoff.

2.2.3 Regional Geology

A conceptual understanding of geology and hydrology is necessary to the evaluation of contaminant migration and monitoring of groundwater and surface water pathways. Information that has contributed to this understanding includes the *Seismic Investigation of Rocky Flats Plant* (Dames and Moore 1981), the *Phase I Geologic Characterization Report* (EG&G 1991b), the *Phase II Geologic Characterization - Data Acquisition Surface Geologic Mapping of the Rocky Flats Plant and Vicinity* (EG&G 1992c), the *Draft Final Well Evaluation Report* (EG&G 1993a), and the *Final Background Geochemical Characterization Report* (EG&G 1992d).

The geologic media in the vicinity of RFP can be grouped into two general categories: consolidated bedrock and overlying unconsolidated surficial deposits. The structural and tectonic features of the region are important because of their effects on the occurrence and flow of groundwater and surface water.

2.2.3.1 Bedrock Stratigraphy

The rocks in the region range in age from Precambrian to Holocene. Precambrian-aged gneiss, schist, and quartzite form the core of the Front Range and are found at a depth of about 12,000 feet (3,700 meters) below RFP. A laterally extensive sequence of Paleozoic-, Mesozoic- and Cenozoic-aged sedimentary rocks unconformably overlie the Precambrian-aged basement rocks. The contact between the basement rocks and the overlying sedimentary strata dips steeply eastward toward the Denver Basin (Dames and Moore 1981). The Upper Cretaceous-aged strata dip steeply to the east along the western limb of an asymmetrical north-south trending syncline (western edge of the Denver Basin). These strata are nearly flat-lying to gently east-dipping beneath RFP.

The sedimentary section is approximately 12,000 to 13,000 feet thick and consists of fluvial, deltaic, and marine strata. A generalized stratigraphic column of the Golden-

Morrison area (a few miles south of RFP) and a generalized cross section from the Front Range to the Denver Basin are presented in Figures 2-9 and 2-10. The upper bedrock formations pertinent to RFP are shown in a generalized stratigraphic column (Figure 2-11) and are described below:

- Fox Hills Formation (late Cretaceous). The Fox Hills Formation is a light brown to brown-orange, silty, fine- to medium-grained sandstone with interbedded sandy shale. The formation is slightly calcareous and characteristically contains iron concretions. The upper Fox Hills Formation sandstone may be difficult to distinguish from the overlying Laramie Formation. The basal Fox Hills Formation interfingers with the Pierre Shale, and often contains more than 50 percent shale.

- Laramie Formation (late Cretaceous). The Laramie Formation consists of interbedded light to medium gray-brown quartzose sandstone and variegated shale, claystone, and coal beds. It is divided into two intervals: a lower unit (about 300 feet thick) of sandstone, siltstone, and claystone with coal layers; and an upper claystone unit (Weimer 1973, EG&G 1991c). The coal and clay seams within the lower 200 feet (60 meters) of the formation have been extensively mined along the Front Range. Basal Laramie Formation sandstones are fine- to coarse-grained, poorly sorted, subangular, and silty, and form prominent hogbacks west of RFP.

  The upper interval of the Laramie Formation, about 500 feet thick at RFP, consists of light to medium gray, kaolinitic claystone with some dark gray to black carbonaceous claystone (EG&G 1991b).

- Arapahoe Formation (late Cretaceous). The Arapahoe Formation is an interbedded sequence of brown and gray quartzose sandstone, siltstone, and claystone. Beds are commonly discontinuous. The base of the formation is commonly marked by a conglomeratic unit. Currently, the contact between the Arapahoe and Laramie

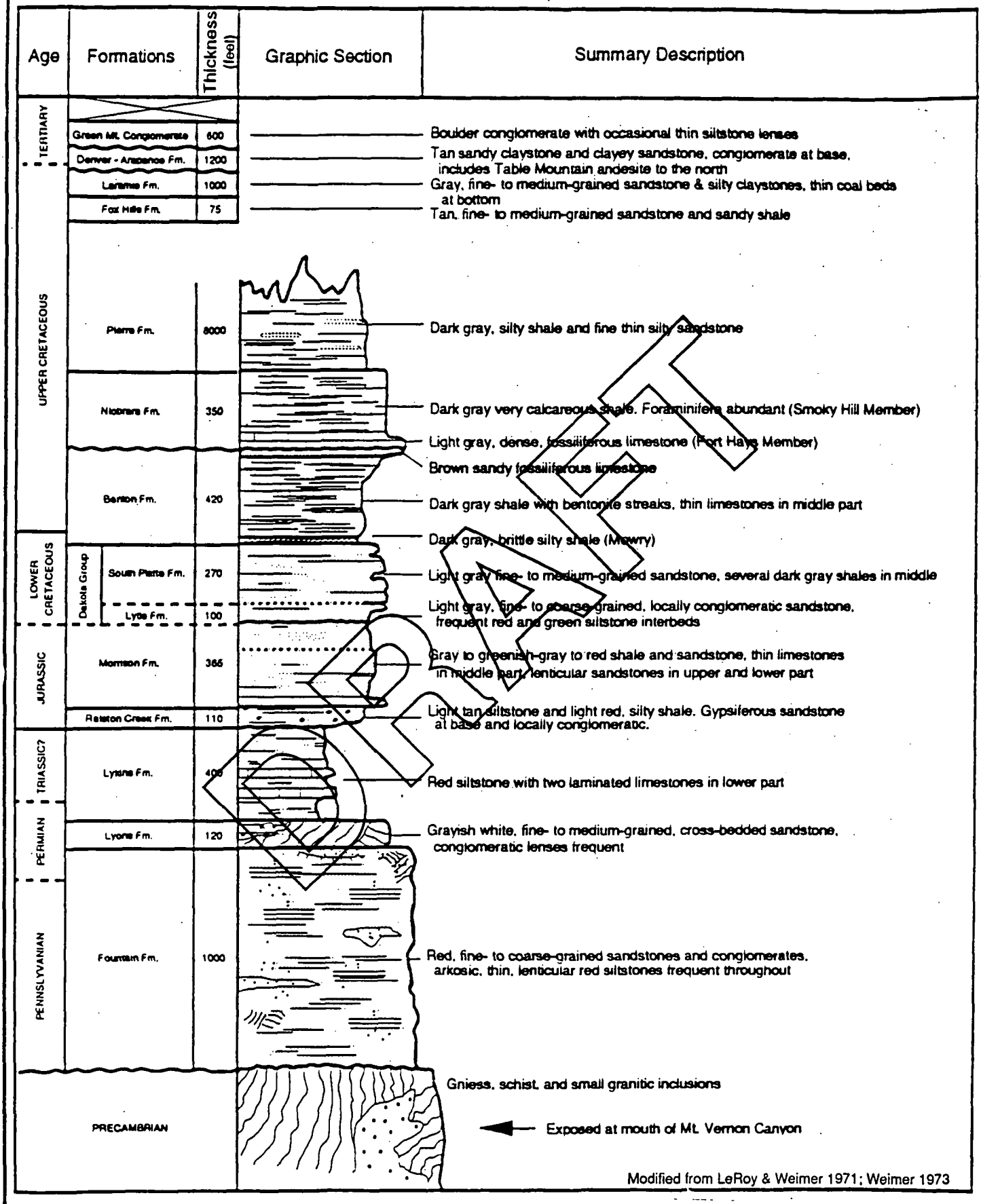
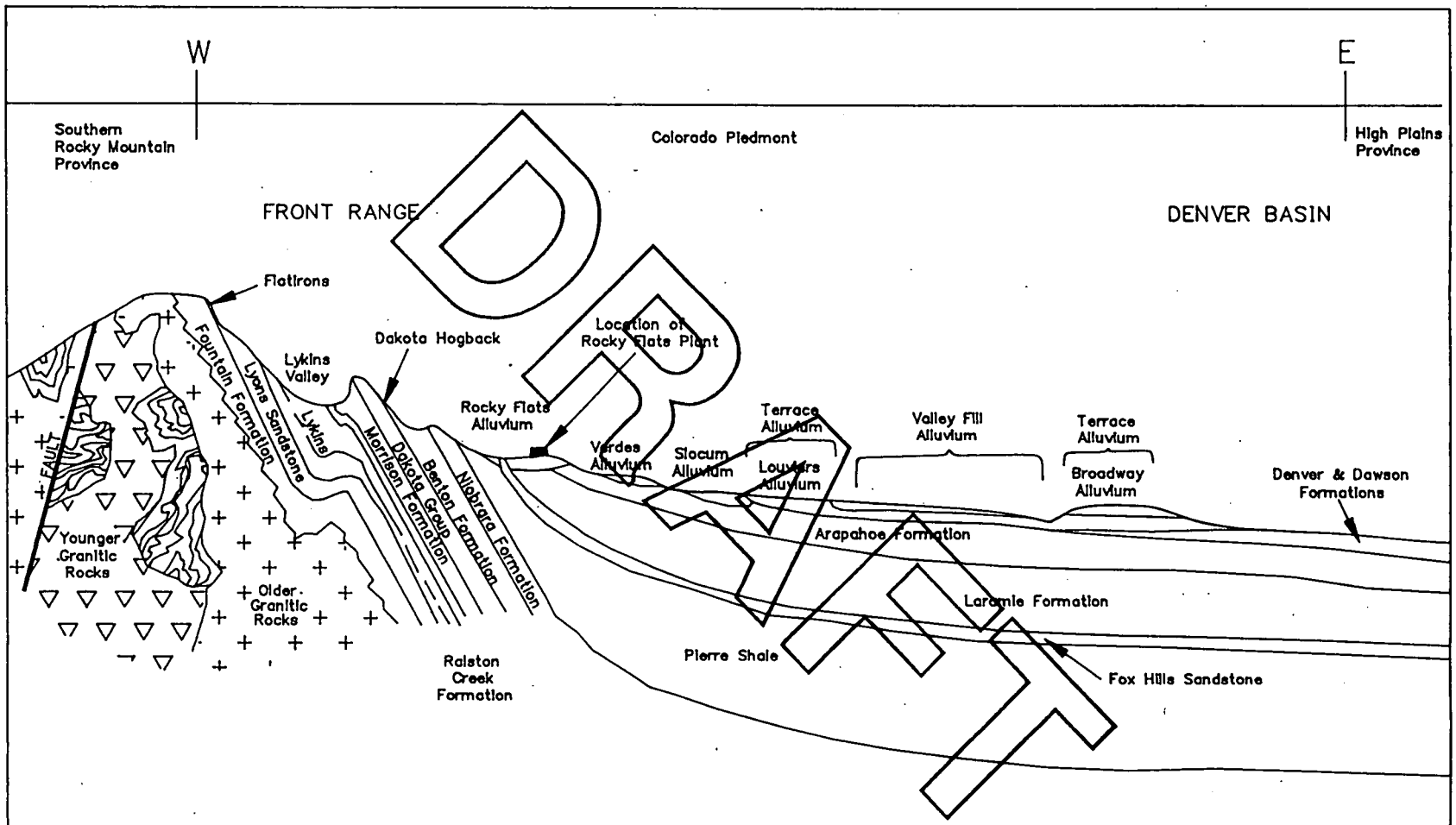


FIGURE 2-9
Industrial Area IM/IRA/DD
Generalized Stratigraphic Section, Golden-Morrison Area
Rocky Flats Plant



(Based on EG&G 1992d)

(After: Boulder County Planning Commission 1983 and Scott 1960)

U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 2-10
INDUSTRIAL AREA IM/IRA/DD
Generalized East-West Cross Section
Front Range to Denver Basin

a:\rfiats\to\jrwfig211.dwg 05H60300

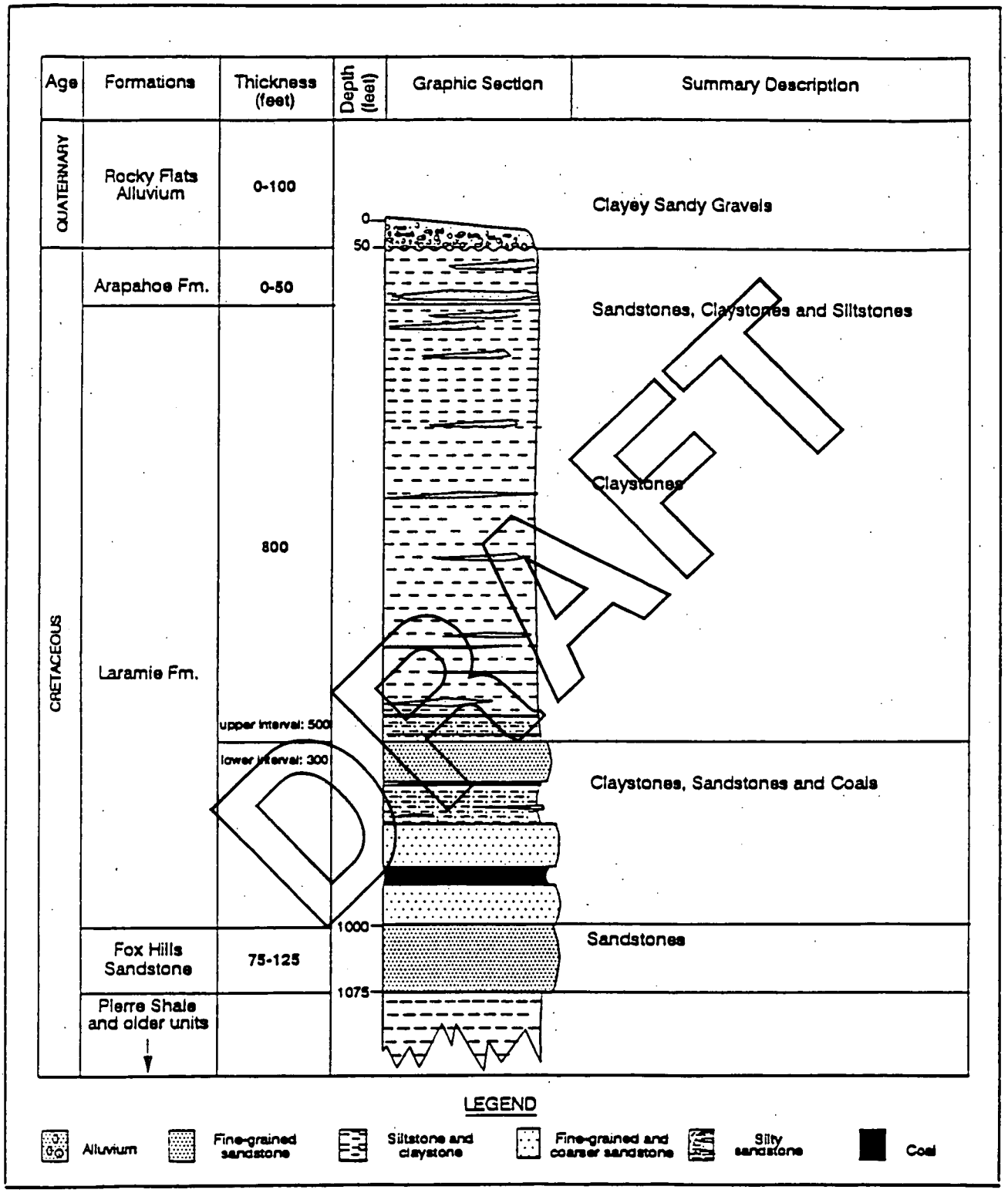


FIGURE 2-11
Industrial Area IM/IRA/DD
Generalized Stratigraphic Section
Rocky Flats Plant

Formations is not clearly defined at RFP. Most of the Arapahoe and Upper Laramie Formation sandstones are very fine- to medium-grained, poorly to moderately sorted, subangular to subrounded, silty, and clayey. An upper coarse-grained conglomeratic sandstone has also been identified.

2.2.3.2 Quaternary Stratigraphy

The Quaternary-aged sequence of sedimentary deposits along the Front Range presents a detailed record of the climatically influenced cyclic processes of erosion, deposition, and relative stability. Deposits of alluvium, colluvium, landslide materials, and artificial fill form an extensive sedimentary cover throughout RFP. The most comprehensive mapping of Quaternary-aged alluvial surfaces in this area was conducted by Scott (1961; 1962; 1963). Eight Quaternary-aged alluvial deposits, each associated with a separate period of deposition, are recognized in the Front Range area. The oldest of these deposits are described below:

- Pre-Rocky Flats Alluvium. The pre-Rocky Flats Alluvium is the oldest Quaternary-aged deposit in the area and occurs as two small isolated, gravel-capped remnants in the vicinity of the Coal Creek drainage. This alluvial deposit consists of medium brown, poorly sorted, angular to well-rounded, bouldery and sandy gravel. The base of the deposit occurs approximately 50 feet (15 meters) higher in elevation than the top of the next lowest surface (Rocky Flats Alluvium).

- Rocky Flats Alluvium. The Rocky Flats Alluvium forms an extensive fan emanating from the mouth of Coal Creek Canyon, 3 miles west of RFP. The alluvium is thickest west of RFP, near Coal Creek Canyon, and thinnest east of the Industrial Area, near the depositional limit of the alluvial fans. Deposits of smaller areal extent occur in the Golden Quadrangle to the south and other very small, isolated patches of Rocky Flats Alluvium occur elsewhere. The upper surface of the Rocky Flats Alluvium in the vicinity of RFP forms a gently eastward-sloping

surface that is dissected by numerous eastward-flowing streams. The alluvium consists of medium to dark red-brown, poorly to moderately sorted, poorly stratified, silty, sandy, and bouldery gravel, derived predominantly from the Coal Creek quartzite to the west. Exposures of the alluvium indicate that the deposit is generally on the order of 40 to 50 feet (12 to 15 meters) thick, but is reported to be as thick as 90 to 100 feet (27 to 30 meters) in buried channels (Ackerman 1974; Oliviera 1975). The age of the Rocky Flats Alluvium is estimated to be 1,000,000 to 2,000,000 years before present (Scott 1960), based on its topographic relationship to the next youngest deposit.

- Verdos Alluvium. The Verdos Alluvium is similar in structure and texture to the Rocky Flats Alluvium, but contains a much more diverse suite of deposits. Whereas the Rocky Flats Alluvium occurs primarily as a large alluvial fan extending eastward from Coal Creek Canyon, the Verdos alluvial surfaces are composed of alluvial fan deposits, stream terrace deposits, and smaller pediment deposits flanking the Rocky Flats surface. Alluvial terrace deposits have been mapped south and west of the RFP Industrial Area.

2.2.3.3 Regional Structure and Tectonics

Structurally, RFR is located along the western margin of the Denver Basin about 4 miles to the east of the Front Range uplift. The Front Range is the most easterly range of mountains in the Southern Rocky Mountain physiographic province. The current Rocky Mountains formed during the Laramide Orogeny, which occurred 67.5 to 45 million years before present. The Laramide Orogeny is believed to have begun as a broad, gentle uplift that caused the regression of the Cretaceous sea from the area (Lovering 1929; Reichart 1953). The orogeny continued with continental margin sedimentation and volcanism, and culminated with rapid uplift and erosion, exposing the Precambrian crystalline core of the Front Range.

The Denver Basin extends eastward from the eastern border of the Front Range into western Nebraska and northwestern Kansas. The basin is an asymmetrical down warp with a steeply dipping west flank and a broad, gently dipping eastern flank. The basin contains more than 13,000 feet of Paleozoic, Mesozoic, and Cenozoic sedimentary rocks (described in Section 2.2.3.1) overlying a Precambrian basement.

No active faults are known to exist along the Front Range in the area from Golden to Boulder, Colorado. The Eggleston Fault, which was mapped by Spencer (1961) and later projected onto RFP (Hurr 1976), was investigated in great detail in 1981 and is now believed not to exist at RFP (Dames and Moore 1981). A thrust fault with a maximum throw of about 80 feet has been mapped at a depth of approximately 3,600 feet in the Pierre Shale directly beneath RFP. The thrust formed over 45 million years before present during the Laramide Orogeny and is no longer active (EG&G 1990). Other faults with larger apparent displacements have been mapped below RFP and are identified in the *Deep Seismic Report* (EG&G 1993b).

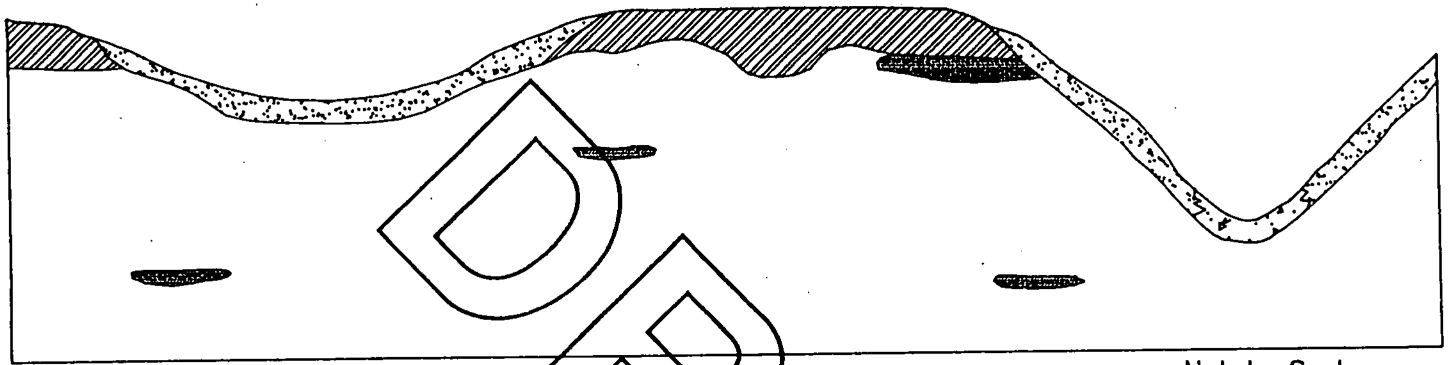
2.2.4 Site Geology

The geologic units important to the Industrial Area IM/IRA are the surficial deposits and the shallow bedrock. A generalized north/south cross section of RFP is given in Figure 2-12.

2.2.4.1 Surficial Deposits

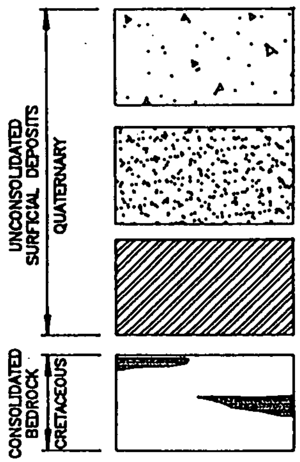
Three general types of unconsolidated, surficial, Quaternary-aged deposits have been identified at RFP: (1) Pleistocene-aged alluvium, (2) Holocene-aged colluvium, and (3) valley-fill alluvium. Slump or landslide deposits, derived from unconsolidated surficial deposits and bedrock, also commonly occur on valley slopes in the steep, central part of RFP.

GENERALIZED CROSS SECTION



Not to Scale

GENERALIZED LITHOLOGY



VALLEY FILL ALLUVIUM: clay, silt, and pebbly sand with silty and cobbly gravel lenses.

COLLUVIUM: clayey coarse gravel and coarse sand, slope debris derived from Rocky Flats Alluvium and outcropping bedrock.

ROCKY FLATS ALLUVIUM: poorly sorted, angular to subrounded cobbles, coarse gravels, coarse sands, and gravelly clay, lenses of clay, silt, and sand.

BEDROCK: claystone and siltstone, varying amounts of clay, silt, and sand, weathered intervals, sandstone lenses.

U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 2–12
INDUSTRIAL AREA IM/IRA/DD
Generalized Cross Section and Lithologic Description
Rocky Flats Plant

c:\rflats\sw\swfig212.dwg 05H60300

Pleistocene-aged deposits consist primarily of Rocky Flats Alluvium, which is the most prominent unconsolidated surficial deposit at RFP. Based on mapping compiled by Hurr (1976) and EG&G (1992e), the Rocky Flats Alluvium underlies most of the Industrial Area at RFP, provided it has not been removed and replaced with artificial fill materials. In this area, thickness of the alluvium ranges up to 50 feet or the alluvium is absent where it has been removed by erosion and downcutting by tributaries of Walnut and Woman creeks. In the central portion of RFP, the deposit is approximately 15 to 25 feet thick. Borehole logs reveal a relatively high degree of heterogeneity within the Rocky Flats Alluvium (EG&G 1993a). In the RFP area, the alluvial material commonly consists of unconsolidated, poorly sorted, coarse gravels, coarse sands, and gravelly clays with discontinuous lenses of clay, silt, and sand. Geologic materials native to the site (Rocky Flats Alluvium) and imported materials have been used as fill at RFP for road grade and berm construction, recontouring peripheral to structures, local valley fill, fill of topographic lows, and for construction of surface impoundments. Crushed rock has been used for landscaping and leveling at the site. Throughout most of the Industrial Area, the land surface is covered with pavement and imported gravel, in addition to buildings and disturbed ground.

Colluvial deposits are locally present on steeper slopes flanking stream drainages that extend across RFP. These deposits, derived from Rocky Flats Alluvium and Arapahoe Formation, were formed by slope wash and downward creep. Throughout the steeper slopes and valleys at the RFP, most bedrock is concealed beneath soil and draped colluvial material. Thicknesses of colluvium generally range from 0 to 20 feet (EG&G 1993a), with the thickest colluvial deposits at the base of these valley slopes. Colluvial deposits are composed of clay, clayey gravels, and gravelly clays, with lesser amounts of sand and silt.

Valley-fill deposits are fluvial sediments that typically consist of clay, silt, and sand with gravel lenses. Valley-fill deposits occur along the lowland areas in and adjacent to

stream beds. These deposits occur most commonly in the eastern part of the RFP, and range in thickness from 0 to 25 feet (EG&G 1991b).

2.2.4.2 Bedrock Deposits

The surficial deposits unconformably overlie bedrock of the Upper Cretaceous-aged Arapahoe and Laramie Formations. The Arapahoe Formation is less than 50 feet thick in the central portion of RFP, based on field mapping (EG&G 1992c). It consists primarily of siltstones and claystones, and contains a basal sandstone commonly referred to as the Number 1 sandstone. The Laramie Formation contains at least four separate, discontinuous but mappable sandstone units. The shallow Arapahoe (Number 1) sandstone is of concern as a potential contaminant pathway because of its high hydraulic conductivity.

The Number 1 sandstone is interpreted to be a fluvial sand channel deposit. It is fine- to medium-grained, locally conglomeratic, well sorted, subangular to subrounded, moderately friable, highly weathered, and heavily iron stained. The thickness of the subcropping sandstone unit ranges from 0.5 foot in Well 2086 (Figure 2-6) to greater than 11.5 feet in Well 3186, and up to 48 feet in the OU2 area (EG&G 1993c). Usually, the Number 1 sandstone is underlain and flanked by finer units such as siltstone or claystone, and a minimum of three fining upward sequences have been recognized in the unit.

The other four sandstone units (Number 2 through Number 5), which occur in the bedrock beneath the Number 1 sandstone, have been identified as lenticular sandstones, siltstones, and claystones that are not continuous or correlative at RFP. These units are part of the Laramie Formation (EG&G 1992c). They are thinner and more silt- and clay-rich than the Number 1 sandstone, display less lateral continuity, and do not exhibit depositional characteristics typically associated with channel sandstone (EG&G 1991b; EG&G 1992c). Although they are in claystones and are not in hydraulic connection with

the Number 1 sandstone or the unconsolidated surficial deposits, the Number 2 through Number 5 sandstones may provide preferential pathways for groundwater flow in bedrock in the Industrial Area.

The top of the bedrock surface reflects the remnants of the pre-Wisconsin-aged pediment as well as the effects of Holocene-aged stream incisement (EG&G 1991b). Recent headward erosion of Rocky Flats Alluvium has exposed the underlying bedrock along North Walnut, South Walnut, and Woman creeks. Contained locally within the underlying bedrock is the Cretaceous-aged Arapahoe Formation Number 1 sandstone. This sandstone, covered by Quaternary-aged colluvium and older Quaternary-aged Rocky Flats Alluvium, subcrops or may be partly eroded by South Walnut Creek in the southeast part of OU8.

2.2.4.3 Stratigraphy and Structure

The general stratigraphy of the RFP is discussed in Sections 2.2.3.1 and 2.2.3.2. Locally, the beds strike north/south and dip to the east or southeast. In the western buffer zone, sediments were folded monoclinally during the Laramide Orogeny. In the western limb of the monoclinal fold, the beds are nearly vertical to overturned. The dip of shallow bedrock flattens to less than 2 degrees to the east under the central portion of the plant (EG&G 1992c).

In addition to the dip of the bedrock, the slope of the topography and location of geologic contacts (relative to land surface) affect the flow of groundwater. Regionally, the topography at RFP slopes to the east, but significant variations in relief occur locally. Valley incision in the central portion of the facility forms east-west trending ridges and east-draining valleys. Shallow bedrock units subcrop and crop out along present stream valleys. The bedrock erosion surface (pediment) dips eastward at greater than 2 degrees, and as a result, the shallow bedrock units are truncated to the east by the erosional surface.

Minor faults and fractures in the shallow bedrock may act as conduits or barriers to groundwater flow and are considered to be potentially significant for the occurrence and migration of contaminants. Borehole logs provide important data regarding the nature and occurrence of fractures and whether fractures are open or closed. However, information is insufficient to fully characterize potential pathways that may result from fracturing in bedrock.

2.2.5 Hydrogeology

This section is a basic introduction to the occurrence and flow of groundwater at RFP. A conceptual model for groundwater flow in the Industrial Area is presented in detail in Section 4.0.

2.2.5.1 Definition of Hydrostratigraphic Units

An aquifer is defined as a geologic formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring (40 Code of Federal Regulations [CFR] 260.1). The water-bearing units at RFP are commonly referred to as hydrostratigraphic units, in part because they yield insufficient water to meet the formal definition of an aquifer. By definition, a hydrostratigraphic unit is composed of geologic materials with similar hydrologic properties. Three hydrostratigraphic units at RFP will be addressed: the upper hydrostratigraphic unit, the lower hydrostratigraphic unit, and the Laramie-Fox Hills Aquifer.

The upper hydrostratigraphic unit consists of several distinct lithostratigraphic units: Rocky Flats Alluvium, colluvium, valley-fill alluvium, landslide deposits, weathered Arapahoe and Laramie Formations bedrock, and all sandstone units within the Arapahoe and Laramie Formations that are in hydraulic connection with overlying unconsolidated surficial deposits or the ground surface. This unit includes the Number 1 sandstone. In

places where the uppermost sandstone is separated from the surficial materials by claystones and silty claystones, it may exist as a semiconfined unit.

The unweathered Arapahoe and Laramie Formations comprise the lower hydrostratigraphic unit. The claystones and silty claystones are generally believed to act as an aquitard, inhibiting the downward groundwater movement to the Laramie-Fox Hills Aquifer.

The Laramie-Fox Hills Aquifer is a deep, confined aquifer comprised of the lower sandstone unit of the Laramie Formation and the Fox Hills Sandstone. The aquifer crops out at the west end of RFP (where it is unconfined) and dips 45 to 50 degrees to the east. Gradually, the dip decreases to less than 2 degrees beneath the central part of RFP (EG&G 1991b).

2.2.5.2 Groundwater Flow

Generally, groundwater within the upper hydrostratigraphic unit flows along the contact of the surficial alluvium with underlying Arapahoe and Laramie Formation claystones. The direction of flow is from west to east, with minor diversions along drainages and paleotopographic highs. Bedrock claystones constrain much of the flow within the upper hydrostratigraphic unit to the surficial alluvium.

In the far western part of RFP, where the thickness of the surficial alluvium is greatest, the depth to the water table is 50 to 70 feet below ground surface (bgs). The depth to water generally decreases from west to east as the surficial material thins. Depth to water in the Industrial Area ranged from less than 2 feet to 22 feet in April 1992, which was a month of historical high water levels at RFP. In the stream drainages north and south of the Industrial Area, seeps are common at the base of the Rocky Flats Alluvium and where Arapahoe Formation sandstones are exposed (EG&G 1991b). In the Industrial Area, water levels in the upper hydrostratigraphic unit are generally lower in wells where

the surficial material is directly underlain by Arapahoe Formation sandstone than in nearby wells where the surficial material is underlain by Arapahoe and Laramie Formations claystone. Rapid changes in water table elevations occur in response to short-term or incident precipitation events and variations in recharge. Water levels are highest in spring and early summer and lowest during the winter months. Some wells are seasonally dry in the Industrial Area.

Groundwater in the Laramie-Fox Hills Aquifer flows to the east or southeast in the RFP area (Hurr 1976; Robson 1983). Water levels measured in bedrock (Arapahoe and Laramie Formations) wells at RFP indicate a strong downward gradient (recharging conditions) (EG&G 1991b) on topographic highs and a slight upward gradient (discharging conditions) in stream valleys (topographic lows) (EG&G 1993a). This conclusion is based on a limited data set, however, and vertical groundwater gradients should be further investigated.

2.2.5.3 Recharge and Discharge

RFP is situated in a regional groundwater recharge area. Recharge to the upper hydrostratigraphic unit occurs as precipitation infiltrates through unconsolidated surficial materials. Most precipitation occurs in the western part of RFP, near the foothills of the Rocky Mountains. Groundwater flows laterally through the Rocky Flats Alluvium and weathered bedrock under RFP.

The Laramie-Fox Hills Aquifer is recharged primarily where bedrock crops out in the western part of RFP along the west limb of the monoclinal fold. Recharge may also occur where groundwater infiltrates from overlying unconfined groundwater (Robson 1983).

Locally, there are areas of discharge as well as recharge. Seeps occur along bedrock/alluvial contacts on steep hillsides, north and south of the Industrial Area. Here,

groundwater may evapotranspire or may feed surface streams. As a result of extensive paving and building construction in the Industrial Area, it is estimated that less than 40 percent of the natural surface materials are exposed directly to incident precipitation (DOE 1992b). Most of the precipitation runoff is diverted to trenches, culverts, and storm-water drains to be conveyed to two surface drainages. Baseflow of some of the perennial streams is sustained by this groundwater discharge and surface water runoff.

2.2.6 Climate and Meteorology

Atmospheric transport of contaminants from RFP is controlled by climate, local meteorology, topography, onsite structures, and by contaminant type and concentration. Information regarding these factors is necessary to evaluate potential contaminant migration pathways from the Industrial Area.

Climate at RFP is strongly influenced by the Front Range of the Rocky Mountains. Dry, cool winters with some snow cover and warm intermittently moist summers are typical. Temperatures at RFP average a maximum of 24.4 degrees Celsius (°C) (76 degrees Fahrenheit [°F]) and a minimum of -5.56°C (22°F). Annual mean temperature is 9.78°C (49.6°F). Recorded RFP temperature extremes range from 38.89°C (102°F) in July to -32.22°C (-2°F) in January (Schleicher and Schuell 1982). Infrequent cloud cover over the region allows intense solar heating of the ground surface. The low absolute humidity permits rapid radiant cooling at night. Relative humidity averaged 46 percent from 1954 to 1976 (Rockwell 1986).

Regional topography and upper-level wind patterns combine to create a semiarid climate along the foothills of the Front Range. Average annual precipitation is approximately 15 inches, 40 percent of which falls during the spring season, much of that as wet snow. An additional 30 percent of the annual precipitation occurs as summer thunderstorms (June to August). Autumn and winter are drier, accounting for 19 and 11 percent of

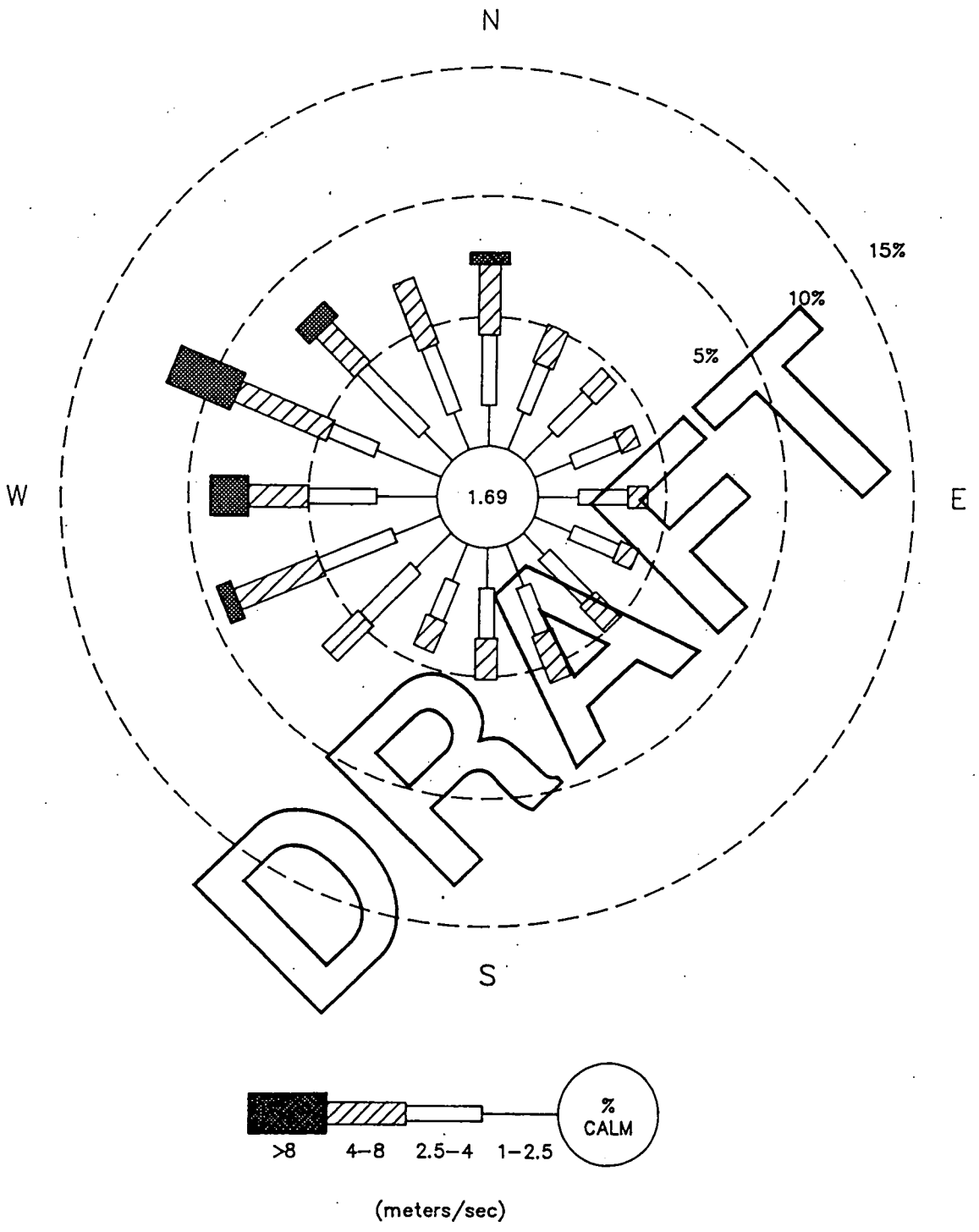
annual precipitation, respectively. Snowfall averages 85 inches per year, falling from October through May (DOE 1980).

Although the RFP site-specific data are limited, annual evaporation at the RFP site is estimated to be between 31 and 38 inches. This number is based on long-term records at Cherry Creek Dam and Fort Collins, respectively (Advanced Sciences, Inc. [ASI] 1991a).

Meteorology is influenced by local topography, regional mountain ranges, and large-scale weather systems. The orientation of the Front Range greatly affects local winds. RFP lies in a belt of prevailing northwesterly winds that are normally channeled across the eastern Rocky Flats geomorphological bench. High velocity winds have been recorded at RFP under these meteorological conditions. High winds occur most frequently in the spring.

Mean wind speed at RFP for 1990 was 9.0 miles per hour (mph). The highest reported wind speed was 88.6 mph. Figure 2-13 illustrates the annual RFP wind frequency distribution facing true compass point directions (EG&G 1991d). The predominance of northwesterly winds and low frequency of winds greater than 15.6 mph (7 meters per second) with easterly components is typical for RFP (DOE 1992a).

RFP is affected by downslope winds from Front Range canyons. These channeled airflows are especially pronounced under conditions of strong atmospheric stability. Similarly, daily cycles of mountain and valley breezes occur at RFP. The general upslope air pattern condition for the Denver area is north to south with flow up the South Platte River Valley entering Front Range canyons. After sunset, air that contacts mountain surfaces cools and moves downslope, flowing in a pattern opposite of upslope movements. Downslope flows converge with the South Platte River Valley flow and move toward the north-northeast.



U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 2–13
INDUSTRIAL AREA IM/IRA/DD

Wind Rose for the Rocky Flats Plant
1992

c:\rfdata\sw\swwr.dwg 05H60300

100% RECYCLED

Strong surface air convections commonly produce thunderstorms during the summer. This activity causes severe and locally unpredictable anomalies in airflow. Late winter and spring conditions can also be influenced by Chinook windstorms. Chinooks are strong winds that move from west to east over the continental divide, often reaching 70 to 80 mph, but also have been recorded in excess of 120 mph at RFP (Rockwell 1989).

2.2.7 Ecology

A variety of plant life is found within RFP. The dominant vegetation found on the western portion of the site is disturbed mixed prairie, a mixture of both short and mid-length grasses. Short grasses are dominant in the eastern part of RFP and are disturbed through overgrazing. Sedges and rushes are found in stream floodplains and wet valley bottoms. Cottonwoods and cattails line many riparian areas.

Since acquisition of the buffer-zone property vegetative recovery has occurred, as evidenced by the presence of disturbance-sensitive species such as big bluestem and sideoats grama. Ute Ladies'-tresses (*Spiranthes diluvialis*) has been placed on the Threatened and Endangered Species List. The habitat of this plant species has been identified in riparian areas of Colorado, specifically in meadows in the City of Boulder (Boulder County) and along Clear Creek in Jeffco. To date, the plant has not been identified in drainages within RFP. No vegetative stresses attributable to hazardous waste contamination have been identified.

Animal populations within RFP are typical of western prairie regions. The chain-link fence surrounding the production area limits the occurrence of large mammals, such as mule deer, to the buffer zone. The permanent population of mule deer is estimated to be 100 to 125. A number of small carnivores, such as coyotes, red fox, striped skunk, and long-tailed weasel, are onsite. Small herbivores are common throughout the plant complex and buffer zone. These herbivores include the pocket gopher, white-tailed jackrabbit, and the meadow vole (DOE 1980).

Commonly observed birds onsite include horned larks, western meadowlarks, mourning doves, vesper sparrows, western kingbirds, black-billed magpies, American robins, and yellow warblers. Mallards and other ducks often nest and rear young on several of the ponds. Killdeer and red-winged blackbirds are found in areas adjacent to the ponds. Birds of prey commonly seen in the area include marsh hawks, red-tailed hawks, ferruginous hawks, rough-legged hawks, and great horned owls (DOE 1980).

Rattlesnakes and bull snakes are the most frequently appearing reptiles. Eastern yellow-bellied racers have also been seen. The eastern short-horned lizard has been reported on the site, but these and other lizards are not commonly seen. The western painted turtle and the western plains garter snake are found in and around many of the ponds (DOE 1980).

2.3 EXISTING MONITORING ACTIVITIES

RFP conducts routine radiological and nonradiological environmental monitoring of effluent air, ambient air, surface water, groundwater, tap water, stream sediments, and soil. Ambient air, soil, surface water, and tap water quality are also monitored at locations around RFP by CDH and by cities using surface water downstream of RFP as municipal water supplies. Municipal and CDH monitoring programs are not discussed in detail in this IM/IRA/DD.

2.3.1 Groundwater Monitoring

The current site-wide groundwater monitoring program is an amalgamation of several separate monitoring programs that address distinct regulatory-compliance or site-investigation objectives. Most of the wells at RFP were installed to fulfill site-specific data needs rather than as part of an integrated site-wide monitoring network. Wells are currently classified as RCRA, CERCLA, Background, Boundary/Point of Compliance,

or Special Purpose. Figure 2-6 shows the locations of monitoring wells in and near the Industrial Area.

RCRA-compliance wells are in place at the three RCRA-regulated units at RFP (SEPs, West Spray Field, and Present Landfill). Wells at these RCRA units serve two purposes: upgradient and downgradient RCRA-boundary wells used to obtain chemical data for statistically assessing potential releases from the units, and RCRA-characterization wells used to evaluate the nature and extent of contamination and contaminant migration rates in accordance with the alternate and assessment programs for the units. CERCLA characterization wells have been installed at OUs that have been, or are currently, under investigation. Each of these wells has a specific purpose related to the objectives of RIs at the OU. Long-term (more than two years) monitoring of these wells for characterization purposes is usually not required. Wells classified for background characterization have been used to provide background groundwater quality data. Boundary wells have been installed to monitor groundwater quality as it leaves the site, or at other points of compliance. Special purpose wells have been installed for use in general site characterization programs, to detect leaks or other chemical releases to the environment, for specific investigations such as the nitrate contamination investigation in the SEPs area, and monitoring the performance of dams or other engineered structures.

The analytical suite for groundwater samples (the "standard suite") consists of the following analytes and analyte groups: Target Compound List (TCL) VOCs; water quality parameters; nitrate/nitrite as nitrogen; Contract Laboratory Program (CLP) Target Analyte List (TAL) standard and additional metals (dissolved); tritium, plutonium, and americium (total); cyanide; orthophosphate; SVOCs; polychlorinated biphenyls (PCBs)/pesticides; and the following radioactive isotopes: gross alpha, gross beta, uranium, cesium, radium, and strontium (dissolved).

2.3.2 Surface Water Monitoring

The Surface Water Monitoring Program is designed to monitor various analytes to ensure compliance with regulations, permits, and agreements, to locate the sources of potential surface-water contamination, and to develop a comprehensive water quality database to assist with surface water management. This monitoring program is divided into five subprograms on the basis of functional objectives. These programs, along with their monitoring objectives, include the following:

- Regulatory Compliance Monitoring - to monitor discharges from detention ponds in Walnut Creek and Woman Creek drainages and the Sewage Treatment Plant (STP) outfall for chemical, biological, and radionuclide constituents.

- Routine Operational Monitoring - to monitor various detention ponds, STP, and sites within the main facilities area to characterize water quality from source areas that contribute eventual discharge to Walnut and Woman creeks.

- Routine Site-Wide Surface Water Monitoring - to monitor seeps and drainages within RFP, to identify areas possibly affected by contaminant releases from suspected source areas, and to compare surface water quality from these areas with water from areas not affected by RFP.

- Site-Wide Storm Event Monitoring - to monitor surface water quality and flows during the rainfall and snowmelt events at stations along Woman, Walnut, and Rock creeks within the RFP boundary.

- Sediment Sampling - to monitor sediments within RFP and at offsite reservoirs to determine the fate and transport of contaminants adsorbed by sediments and to determine source areas of contaminants.

2.3.3 Air Quality Monitoring

The purpose of the Air Quality Monitoring Program is to protect the health of plant workers and the general public and to comply with applicable state and federal air quality regulations through the detection and measurement of air emissions and ambient air conditions. The Air Quality Monitoring Program is divided into four subprograms on the basis of functional objectives. These programs, along with their monitoring objectives, are as follows:

- Radiological Effluent Emissions Monitoring - to monitor particulate emissions of building exhaust ducts for plutonium, americium, and uranium; gaseous emissions of building exhaust ducts for tritium; and with real-time detection and automatic alarms for abnormal alpha activity.

- Nonradiological Effluent Emissions Monitoring - to monitor building exhaust and duct emissions for beryllium.

- Radiological Ambient Air Monitoring - to monitor ambient air concentrations of plutonium particulates within and near RFP and in local communities and to monitor ambient plutonium concentrations within specific OUs for remediation activities pursuant to the IAG.

- Nonradiological Ambient Monitoring - to monitor nonradioactive suspended particulates in ambient air in accordance with EPA regulations on criteria pollutants (TSP and PM-10).

2.3.4 Soils Monitoring

The purpose of the Soil Monitoring Program is to characterize temporal changes ir plutonium concentrations across RFP, as well as spatial and vertical distributi

plutonium respective to specific remediation areas. The Soil Monitoring Program is divided into the following two subprograms:

1. Site-Wide Soil Monitoring - to monitor annual changes in plutonium concentrations, possibly occurring through soil resuspension and other mechanisms.

2. Remediation Site Soil Monitoring - to monitor the spatial and vertical extent of plutonium and americium in soils of the RI areas and in the buffer zone east of the main facilities area.

Currently, an active soil-monitoring program is not in place in the Industrial Area, although soil sampling is expected to be an integral part of D&D activities and continued OU investigations. The existing program to monitor plutonium concentrations in buffer zone soils is discussed below, along with recent soil sampling that has occurred in the Industrial Area.

The site-wide program consists of annual sampling for plutonium and americium at 1- and 2-mile radii (1.6 and 3.2 km) from the center of the plant. This radial grid was chosen to investigate plutonium distribution patterns using RFP as a point source. Samples are collected from 40 monitoring sites (30 meters square) at 18-degree intervals along the circumferences of the two circles (Figure 2-14). Data from the composite samples are evaluated for changes in americium (since 1988) and plutonium concentrations as a result of soil resuspension or other mechanisms. Some variation has been observed from year to year, particularly within a 120-degree swath east and southeast of the 903 Pad, but this has been attributed to inhomogeneity of the wind-deposited radionuclides in the soil (EG&G 1992d). Plutonium and americium concentrations at annual monitoring locations outside this zone exhibit much less variation and are typically very close to background levels. None of the annual monitoring locations fall within the Industrial Area.

The Remediation Site monitoring is specific to each OU and includes the RI areas and the buffer zone east of the Industrial Area. The scope of the Remediation Site Soil Monitoring Program is defined by the IAG, which requires soil sampling of OU1 (881 Hillside), OU2 (903 Pad, Mound, and East Trenches), and OU3 (offsite). Additional sampling is being conducted in OU5 (Woman Creek) and OU6 (Walnut Creek). The general intent of these sampling efforts has been to determine the nature and extent of organic, inorganic, and radionuclide contamination in soils and sediments at IHSSs. Most of these efforts are expected to be one-time sampling events to guide future work, but OU2 shallow vadose zone water movements are being studied at five soil trench locations immediately outside the southeastern portion of the Industrial Area. The movement of interstitial water and radionuclides in the vadose zone at these locations is monitored continuously, and the water is periodically analyzed for total, dissolved, and colloidal plutonium and americium, in addition to a suite of physical parameters.

Two different methods have been used in sampling soils at RFP. The annual soil monitoring in the buffer zone is performed using RFP Standard Operating Procedure (SOP) GT.08, in which 10 subsamples are composited from two 1-meter squares within a 30-meter-square sample plot. Recent sampling in support of the OU2 RI (EG&G 1993d) was performed using a method developed by CDH, which uses 25 subsamples composited from a much larger sample plot, either 2.5 or 10 acres. The CDH method has the advantages of a more representative sample from the air-soil interface and should be less affected by topographic/homogeneity problems as a result of the larger number of subsamples. A disadvantage is the amount of disturbance to the sample plot each time it is sampled. The RFP method has the advantage of sampling a relatively undisturbed sample plot to a depth that would also measure radionuclides transported down into the upper 5 cm of the soil horizon by water, liquid contaminant, or other means. It should be noted that the OU2 sampling also incorporated a thorough sampling of the upper 1.0 meter of the soil horizon using soil pits and trenches at selected sample plots. This sampling has provided valuable information regarding the movement of radionuclides in

the vadose zone that can be applied as a model elsewhere at the plant, but would be impractical as a routine monitoring tool.

In September 1991, an extensive soil sampling program was undertaken in support of the ongoing investigations at the 903 Pad, East Trenches, and 881 Hillside. Composite samples were collected from eighty-four 10-acre plots and thirty-four 2.5-acre plots located in the southeast quadrant of the Industrial Area and east to Indiana Street. An additional 11 samples were collected from each of 26 soil profiles, excavated to a depth of 1.0 meter. Instrumentation was installed at five excavation sites immediately adjacent to the southeastern boundary of the Industrial Area, and at these locations, water movement in the vadose zone is monitored continuously. In addition, samples of the interstitial water are periodically acquired and analyzed for total, dissolved, and colloidal plutonium and americium, in addition to a suite of physical parameters.

Soil sampling is very well-suited to characterizing contaminated sites, less well-suited for long-term monitoring, and unsuitable for short-term monitoring programs of five events or less. Although soil is frequently the first environmental medium to receive contaminants during a release (particularly liquid contaminants), it is the least likely to act as a transport medium. In general, contaminants in soil are more likely to be remobilized by volatilization (to air), dissolution (to groundwater or surface water), suspension in water (to storm water runoff or to groundwater or surface water as colloidal material), or airborne transport (as a result of moderate or high wind activity). Soils may be susceptible to transport by even low-energy wind activity if soil has been disturbed.

Soils are less conducive to monitoring programs because when a soil location has been sampled and disturbed, an adjacent (or nearby) location must be used the next time, introducing an unavoidable sampling bias. This problem can largely be reduced by taking composite samples over large areas (as was done recently in OU2, the CDH method), but the effects of the inhomogeneity of contaminants in a soil medium and

disturbance of an area during repeated sampling cannot be totally overcome. Generally, at RFP, the objective of a soil monitoring program is to track radionuclide contamination at the air-soil interface to monitor for net losses or gains as a result of remobilization or deposition by wind.

Because of the nature of soil contamination (i.e., a contaminated medium, but not a transport medium), most long-term monitoring has been focused on transport media (air, surface water, and groundwater). However, considerable soil and surface water sediment sampling in support of OU activities has occurred recently (EG&G 1993c). As of December 1992, several programs were completed, planned, or in progress, including (1) OU1 - 881 Hillside (280 soil samples, 85 sediment samples), (2) OU2 - 903 Pad, Mound, East Trenches (48 boreholes, 625 soil samples, five soil trenches, 20 soil pits), (3) OU3 - Offsite (250 soil samples, 230 sediment samples), (4) OU4 - Solar Ponds (soil sampling in two boreholes), (5) OU5 - Woman Creek (eight soil borings, unspecified number of sediment samples), (6) OU6 - Walnut Creek (48 soil borings sampled [of 105 proposed], 50 pond sediment samples), (7) OU7 - Present Landfill (250 soil samples, soil sampling continuing), (8) OU9 - OPWL (soil borings, test pits planned), and (9) OU13 - 100 Area (comprehensive surficial soil sampling planned).

The current site-wide programs to monitor potential soil transport media, combined with the annual soil monitoring program in the buffer zone, are adequate at this time to monitor any remobilization of plutonium- and americium-contaminated soils. Soil sampling and monitoring programs specific to the individual OUs will provide a detailed characterization of contamination at individual sites.

2.3.5 Footing Drains and Incidental Waters

Aperiodic sampling and analysis of footing drain waters is conducted for a variety of analytes, including organic compounds, metals, and radionuclides. Fifteen foundation drains and building sumps are sampled quarterly and analyzed for pH, conductivity,

radionuclides, total dissolved solids (TDS), and nitrate. The majority of the footing drains discharge directly into storm drains or surface water drainages. These waters are analyzed under the surface water program.

Incidental waters that collect on the ground surface, on drums, around tanks, and in berms and excavations are collected and sent to the process waste treatment facility in Building 374. These waters are discussed further in Section 7.3.

2.4 MONITORING FOR DECONTAMINATION AND DECOMMISSIONING ACTIVITIES

Currently, D&D activities are not well defined but involve the removal of fixed materials (including residual constituents of concern), equipment, and facilities, including buildings. Potential activities include the following:

- Remove fixed equipment, piping, and tanks.
- Retrofit equipment for future use.
- Dismantle and remove ventilation systems including glove boxes, ducts, and stacks.
- Modify or renovate buildings.
- Dismantle or demolish buildings.
- Perform building construction.
- Excavate underground equipment, piping, and foundations.
- Excavate UBC.

Environmental and worker safety monitoring for D&D activities will consider the following: (1) facility characterization performed during transition; (2) COPCs for the facility or activity; (3) COPC sources; (4) engineering controls to prevent releases; and (5) levels of COPC detection that require a response, including emergency response. Section 9.0 describes potential D&D activities, an approach for developing a COPC list, recommendations for verification monitoring, and response planning for D&D activities.

3.0 CONSTITUENTS OF POTENTIAL CONCERN, COMPOUNDS OF INTEREST, AND SOURCES

Chemicals were evaluated to identify a preliminary list of potential constituents and/or compounds that may require environmental monitoring in soil, surface water and sediment, groundwater, and air. These materials are designated as either COPCs or COIs based on past or potential releases. Source area locations for compounds (including waste streams) and constituents were also identified for further refinement of media- and pathway-specific environmental monitoring requirements.

3.1 APPROACH

Chemical compounds previously stored, used, or spilled in the Industrial Area were evaluated to identify COPCs and COIs for environmental monitoring. Constituents that were accidentally released to the environment or disposed of improperly by former management practices (COPCs), and chemical compounds or wastes that could be spilled in future accidental releases to the environment (COIs) were identified as the most important chemicals to include in the evaluation of the environmental monitoring system.

These chemicals fit into two groups: (1) constituents or wastes from historical releases, and (2) chemicals that could potentially be involved in an unplanned event such as a spill. Chemicals under the second group are further divided into chemical product inventories that are currently stored in buildings, and process wastes that are also currently stored in buildings. Figure 3-1 shows the general approach to identifying COPCs and COIs. This approach is discussed further in the following subsections.

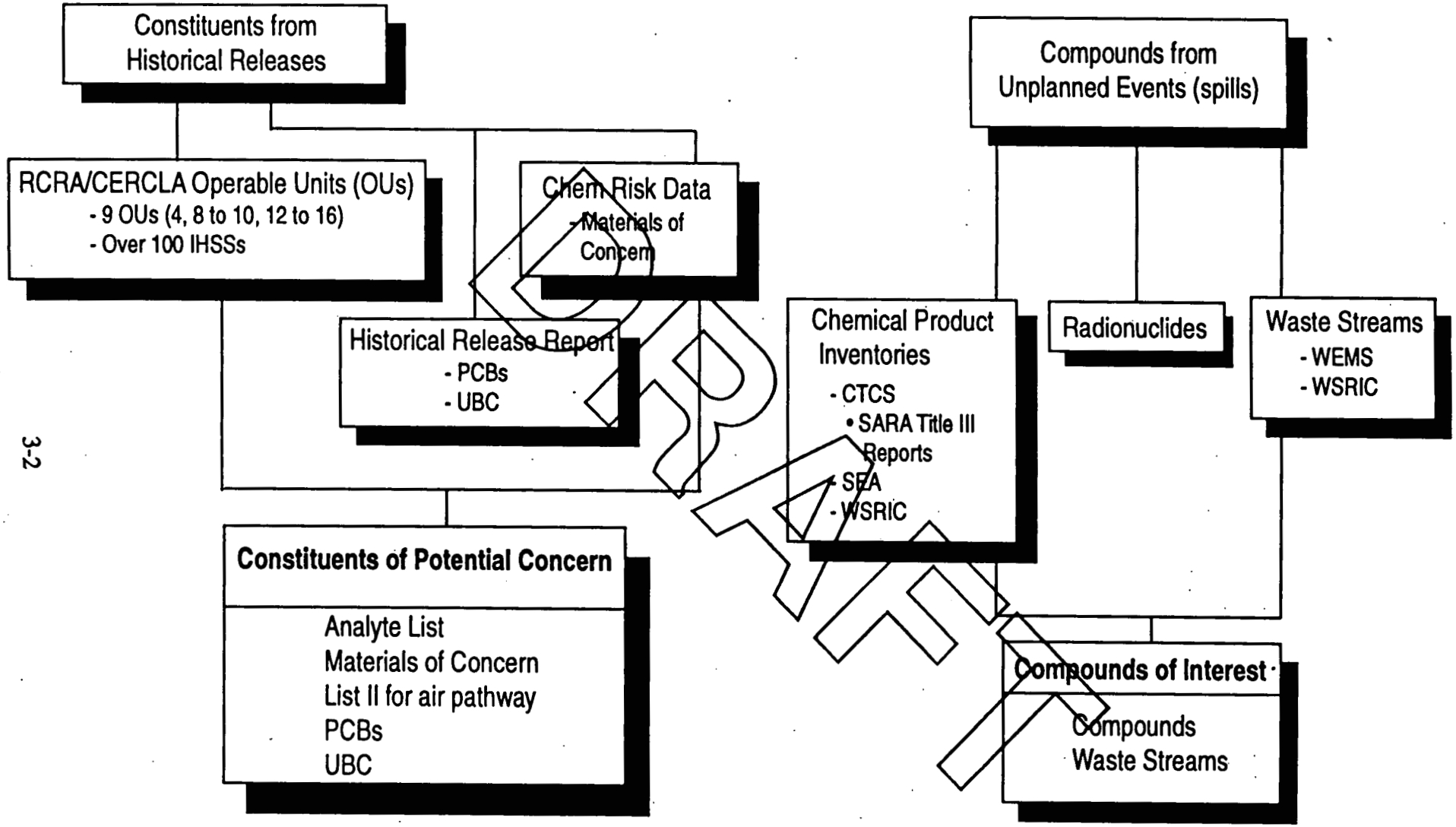


FIGURE 3-1
Industrial Area IM/IRA/DD
Constituents of Potential Concern and Compounds of Interest

3.1.1 Constituents From Historical Releases

Information on constituents from historical releases has been identified under the CERCLA/RCRA program in the IAG among DOE, EPA, and CDH. IHSSs that are located in CERCLA/RCRA OUs are included in the IAG. Nine of these OUs are in the Industrial Area and are listed below:

- OU4 - Solar Ponds;
- OU8 - 700 Area;
- OU9 - OPWL;
- OU10 - Other Outside Closures;
- OU12 - 400/800 Area;
- OU13 - 100 Area;
- OU14 - Radiological Sites;
- OU15 - Inside Building Closures; and
- OU16 - Low-priority Sites.

The list of hazardous substances identified in the IAG was supplemented with other constituents that were identified from information in the *Draft Integrated Field Sampling Plan for OUs 8, 9, 10, 12, 13, and 14* (Jacobs Engineering Group Inc. [Jacobs] 1993a), the *Historical Release Report* (HRR) (EG&G 1992f), the *Plan for Prevention of Contaminant Dispersion* (DOE 1991a), the *Reconstruction of Historical Rocky Flats Operations and Identification of Release Points, Project Tasks 3 & 4* report (CDH 1992), and data from other technical documents, to form an initial set of COPCs. These documents were also used to identify approximate locations of contaminant releases for subsequent source evaluation. Details on the documents that were reviewed are presented in Section 3.2.

In addition, historical releases of PCBs and contamination underneath buildings, or UBC, were evaluated. Thirty-five PCB sites were identified in the *Assessment of Known,*

Suspect and Potential Environmental Releases of PCBs, Preliminary Assessment/Site Description (EG&G 1991e) and the HRR. These locations will be specifically monitored for PCBs. The HRR also identified locations of UBC. PCBs and UBC are discussed in Section 3.2.

3.1.2 Chemical Product Inventories

Chemical inventories for each building in the Industrial Area were obtained from EG&G personnel in the Chemical Tracking and Control System (CTCS) group, which is responsible for meeting the reporting requirements under the Superfund Amendments and Reauthorization Act (SARA) Title III Emergency Planning and Community Right-to-Know Act (EPCRA). Additional information was obtained from the *Fiscal Year (FY) 93 Systems Engineering Analysis (SEA) Facility Characterization and Inventory Report* (EG&G 1993e) and the Waste Stream Residue Identification and Characterization (WSRIC) Database (EG&G 1993f).

The databases of chemical inventories and a list of the COIs are discussed in Section 3.2.

3.1.3 Chemical Waste Streams and Waste Storage

EG&G personnel who maintain data on waste streams and waste storage were contacted for a list of chemical wastes that are located in each building's permitted storage areas (PSA) within the Industrial Area. This list was compiled from the Waste and Environmental Management System (WEMS) Database (EG&G 1993g) and WSRIC Database (EG&G 1993f).

Locations of RCRA-permitted waste storage areas, where large amounts of hazardous wastes could be stored, were identified for geographical-specific evaluation of environmental monitoring systems. These databases, locations of RCRA-permitted storage areas, and the COIs are described in Section 3.2.

3.1.4 Others

Radionuclide chemicals and radionuclide waste streams were evaluated. The list of radionuclide COIs includes all radionuclides and SNM that could be stored in buildings in the Industrial Area and that could be released through unplanned, accidental spills. Radionuclide chemicals are discussed in Section 3.2.

3.2 DESCRIPTION OF DATA REVIEWED

The primary documents and databases that were used to identify COPCs and COIs include the following:

- IAG (DOE et al. 1991);
- *Plan for the Prevention of Contaminant Dispersion* (DOE 1991a);
- *Reconstruction of Historical Rocky Flats Operations & Identification of Release Points, Project Tasks 3 & 4* (CDH 1992);
- *Draft Integrated Field Sampling Plan* (Jacobs 1993a);
- *Draft Environmental Restoration Technical Support Document* (EG&G 1992g);
- *Historical Release Report* (EG&G 1992f);
- RFP CTCS Database (EG&G 1993h);
- *FY93 Systems Engineering Analysis Facility Characterization and Inventory Report* (EG&G 1993e);

- RFP Waste and Environmental Management System (WEMS) Database (EG&G 1993g); and

- RFP Waste Stream and Residue Identification and Characterization (WSRIC) Database (EG&G 1993f).

3.2.1 Constituents of Potential Concern and Sources

As discussed previously, COPCs are those constituents that were released to the environment from historical spills or past waste management practices. The COPCs were compiled from data in RFI/RI documents, the *Reconstruction of Historical Rocky Flats Operations & Identification of Release Points* (CDH 1992) and the *HRR* (EG&G 1992f).

3.2.1.1 Analyte List

The IAG contains a hazardous substance list (or preliminary COPCs) for IHSSs included under the RFI/RI at RFP. This initial list has been replaced with a comprehensive list of analytes that includes TAL metals (plus the metals molybdenum, cesium, strontium, lithium, and tin); TCL VOCs; TCL SVOCs; TCL pesticides and PCBs; radionuclides; indicator parameters; and surfical soil sampling parameters. This list is taken from Appendix B of the *Rocky Flats Plant Site-wide Quality Assurance Project Plan* (EG&G 1991f) and the *Plan for the Prevention of Contaminant Dispersion* (PPCD) (DOE 1991a). The list is presented in Appendix 3.1.

The comprehensive analyte list can be used for preliminary identification of COPCs for the purposes of this report. This preliminary list of COPCs must be further screened to identify the most important COPCs for a particular area. This screening can be accomplished by evaluating the historical use and releases of the constituents at a given area and by using risk-based factors derived from toxicity and exposure data. The latter

was performed for the air-inhalation pathway in the PPCD report. As a result, a smaller list of COPCs (List II) was identified for the air pathway (DOE 1991a). The analytes included on List II are those for which health risk information was available in the Integrated Risk Information System (IRIS) database and the Health Effects Assessment Summary Tables (HEAST). In addition, constituents from the analyte list that did not have published values in IRIS or HEAST are undergoing further toxicological evaluations to determine if they should be included on List II (DOE 1991a). The purpose of the PPCD is to provide a consistent mechanism for assessing the potential for airborne transport of site-specific environmental contaminants caused by IAG-related activities. This evaluation was limited solely to the inhalation pathway. A similar evaluation may be used to screen COPCs for other exposure pathways and different media (soil, surface water and sediment, and groundwater).

The list of preliminary COPCs for the air inhalation pathway is presented as List II in Appendix 3.2.

3.2.1.2 Materials of Concern

The ChemRisk report, titled *Reconstruction of Historical Rocky Flats Operations & Identification of Release Points, Project Tasks 3 & 4* (CDH 1992), was examined to augment the list of COPCs. The objective of this document was to select constituents and radionuclides that were most likely to have posed an offsite human health hazard under historical routine plant operations. An initial set of 629 materials of concern (MOC) was reduced to 32 materials by using a three-stage screening evaluation including factors such as known toxicologic properties, release histories, reported inventory quantities, offsite health hazards, and the likelihood of release and potential quantity of release (CDH 1992). Twelve of the 32 (designated as Group 1) were selected as materials for further evaluation based on the reasonable potential for an offsite release (CDH 1992). These 12 were checked against the list of COPCs on the analyte list. Of the 12 materials, only one (thorium-232) is not included on the analyte list. According

to the ChemRisk report (CDH 1992), thorium was used in several ways at RFP since 1952. The quantities of thorium used varied from none to about 238 kilograms in a given month. The major use of thorium was in the fabrication of metal parts from natural thorium and thorium alloys. The report (CDH 1992) states that thorium may have been used as a mold-coating compound in limited experiments, but never on a production scale, and it was also used in small but numerous analytical procedures and development programs. The report (CDH 1992) also states that a project conducted in the late 1950s to early 1960s involved thorium production. It is reported that the "thorium went through the same processes as enriched uranium, but most was sent to Savannah River or Oak Ridge for recovery."

Three buildings were identified in the ChemRisk report (CDH 1992) where thorium was used in the past: Building 771, where some small-scale thorium work of an unspecified nature was conducted; Building 334, where small quantities of thorium and depleted uranium were sheared; and Building 881, where there was light production of thorium parts and thorium "strikes" to remove impurities from uranium-233. Thorium-232 should be considered for inclusion as a COPC at or near the buildings (334, 771, and 881 [CDH 1992]) where it was used in the past.

3.2.1.3 Integrated Field Sampling Plan and Draft Environmental Restoration Technical Support Document

To identify specific geographical areas or sources where contaminants from past releases may be of concern, the *Draft Integrated Field Sampling Plan* (Jacobs 1993a) and the *Draft Environmental Restoration Technical Support Document (ERTSD)* (EG&G 1992g) were reviewed. The Integrated Field Sampling Plan identifies the locations and major chemical contaminants at each IHSS located in OUs 8, 9, 10, 12, 13, and 14. Information on contaminants and the approximate location of releases for OUs 4, 15, and 16 was taken from the ERTSD (EG&G 1992g). This information is presented in Appendix 3.3. Locations of these IHSSs are presented in Figure 3-2. Based on a

preliminary review of this information, hexavalent chromium is not on the analyte list and should be considered for inclusion as a COPC at certain IHSSs where it may have been released to the environment. (See Appendix 3.3, IHSSs 121, 136.2, 136.3, and 162.) In addition, as the RFI/RI program progresses, sample results may indicate the presence of other contaminants. These contaminants should be reviewed to identify new COPCs.

3.2.1.4 Historical Release Report and Assessment of Potential Environmental Releases of Polychlorinated Biphenyls and Under-Building Contamination

The *HRR* (EG&G 1992g) and the Assessment of Potential Environmental Releases of PCBs (EG&G 1991e) were evaluated to identify locations of potential PCB spill areas and UBC from past releases such as spills. Appendix 3.4 lists the 36 PCB spill locations. Additional information on recent sampling results for PCBs can be obtained from the RFP Environmental Management Department. Locations of UBC taken from the HRR are presented in Appendix 3.5.

3.2.2 Compounds of Interest and Sources

COIs are defined as chemical compounds or wastes that have the potential to be released to the environment during an accident or unplanned event. These substances were identified as the most important compounds to include in the evaluation of the environmental monitoring system since many of these substances may not be included as part of the analyte list. The COIs were compiled from data contained in the RFP chemical product inventories and waste stream inventories. Additionally, sources of radionuclide COIs were identified from the *Reconstruction of Historical Rocky Flats Operations & Identification of Release Points, Project Tasks 3 & 4* (CDH 1992).

3.2.2.1 Chemical Inventory

The CTCS was the primary source of information on the chemical inventory at RFP. As chemical substances are delivered to the central receiving warehouse (Building 130) onsite, it is the responsibility of the field coordinator to inform the CTCS group of the receipt of the substance, its packaging, and the quantity received. In some instances, the chemical compounds are delivered directly to the point of use. In such instances, it becomes the responsibility of the field coordinator assigned to that building to report the receipt and packaging to the CTCS group. After a chemical is dispensed to the end user, it is no longer tracked by the CTCS.

The chemical inventory contains information regarding chemical or substance name, quantity, type of container the substance was stored in, and the building number. Substances listed as nonhazardous on the respective Material Safety Data Sheets (MSDS) were removed from the list. These substances include raw wastewater and nitrogen, argon, propane, and helium gases. In addition, because of the large number of various chemical compounds on the list, compounds that totaled to less than 100 pounds at any particular location were removed. A list of the compounds deleted from the original files list is found in Appendix 3.6, Table A. This list of remaining compounds was augmented with a list of other compounds in quantities greater than 100 pounds obtained from the *FY93 SEA Facility Characterization and Inventory Report* (EG&G 1993e), and the WEMS and the WSRIC databases. The final list of COIs is in Appendix 3.6, Table B.

To ensure that compounds considered toxic in quantities less than 100 pounds are not excluded from this list, the hazardous compounds and extremely hazardous substances, identified as part of the EPCRA Tier II reporting requirements, will be added as soon as the information becomes available. The EPCRA Tier II report was not available in time for this report because the EG&G CTCS group is currently updating it; however, the information will be added to Appendix 3.6 when it becomes available.

3.2.2.2 Waste Streams

Waste and environmental management systems and waste stream residue identification and characterization are discussed in this section.

Waste and Environmental Management System. RFP maintains data on waste streams and waste storage at RFP. The WEMS is stored on a Virtual Address Extension (VAX) system managed by Waste Programs and provides a comprehensive base of information on all waste streams including the buildings, storage units, the types of wastes, and volumes allowed in each unit. This database also contains information on the RCRA designation of each unit and whether the unit is still in use. These data were obtained from the M (or Area Location) reports, which is one of the 26 report types available from WEMS, and were used to help identify COIs.

All wastes stored in satellite collection areas (SCA) were eliminated because these areas contain limited quantities of waste on a temporary basis. Wastes stored in 90-day storage areas were eliminated because these areas are used as accumulation points until the wastes are moved to a permitted storage facility. The inactive PSAs have also been eliminated because they are no longer in use. However, data on these areas are still kept in the database because they are an accurate source of the historical use of these storage locations. The list was reduced to the wastes stored in all of the EG&G designated PSAs as of December 7, 1993, which includes all of the EG&G designated PSAs, permitted storage tanks (PST), and permitted treatment areas (PTA) in the industrial area at the RFP. Appendix 3.7 comprises the lists of permitted storage units, as defined by the WEMS database, and the waste streams and COIs associated with them.

Waste Stream Residue Identification and Characterization. RFP maintains a computerized database that is available from the WSRIC report that includes information on waste stream constituents, EPA codes, and the process stream inputs. The WSRIC database is managed and administered by the Information Resource Group and is used

primarily to track waste streams as they relate to Land Disposal Restrictions (LDR). These data were used to supplement the list of COIs for waste streams.

3.2.2.3 Radionuclides

Other MOCs are the radionuclide elements and waste used and produced during the production operations that occurred at RFP. Six radionuclides were identified as MOCs. The data on these radionuclides and their locations were obtained from the *Reconstruction of Historical Rocky Flats Operations & Identification of Release Points, Project Tasks 3 & 4* (CDH 1992). These COIs are included as Appendix 3.8.

3.3 FINDINGS

The COPC and COI lists identified in this report represent the preliminary phase of screening constituents and COIs. The discussion below highlights the major findings and the limitations of these preliminary COPC and COI lists.

3.3.1 Constituents of Potential Concern

Research was conducted to identify a preliminary list of COPCs for environmental monitoring based on historical releases at RFP. The result of this work is a list of COPCs that include the analyte list (Appendix 3.1) and List II for the air inhalation pathway (Appendix 3.2). Areas that have been affected by releases include IHSSs, PCB-spill areas, and underneath buildings where spills are thought to have occurred (Appendices 3.3, 3.4, and 3.5, respectively).

It is recommended that thorium-232 be considered a COPC at or near Buildings 334, 771, and 881 where it was historically used. Hexavalent chromium should be considered a COPC at IHSSs 121, 136.2, 136.3, and 162 where it may have been released to the

environment. In addition, as information on new constituents is discovered during the RFI/RI, the constituents should be considered for inclusion as COPCs.

The resulting list of COPCs is large. (See Appendices 3.3 to 3.5.) It is recommended that further evaluation be conducted to screen this list at a particular area, for a particular medium, using information on historical spills (Appendices 3.1, 3.2, 3.3, and 3.4) and risk-based criteria such as toxicity and fate and transport. This evaluation is the next step in determining the most important constituents of concern at a given area and, therefore, refining the list of analytes that should be required for environmental monitoring.

3.3.2 Compounds of Interest

The information provided in this report is based solely on the information provided in Section 3.2. The WEMS database changes constantly since ongoing operations in the Industrial Area at RFP involve the consolidation of waste. Thus, certain elements of Appendix 3.7 may be inaccurate in the future. In addition, the list provided in Appendix 3.7 considers only the active, large permitted storage units, as defined by the WEMS database, at the plant site that excludes a number of satellite accumulation and 90-day storage areas.

For the COIs identified from the chemical product inventories, it is suggested that Appendix 3.6 be updated in March 1994 with the chemical compounds reported as part of the EPCRA reports. This report will provide a more accurate inventory on the hazardous substances stored at RFP. These data are in the process of being compiled and were not available at the time of this report.

(intentionally blank)

APPENDIX 3.1
INDUSTRIAL AREA IM/IRA/DD
TARGET COMPOUND LIST

(intentionally blank)

EG&G ROCKY FLATS

ROCKY FLATS PLANT SITE-WIDE

QUALITY ASSURANCE PROJECT PLAN

FOR CERCLA REMEDIAL INVESTIGATIONS/FEASIBILITY STUDIES

AND

RCRA FACILITY INVESTIGATIONS/CORRECTIVE MEASURES STUDIES

ACTIVITIES

ENVIRONMENTAL RESTORATION PROGRAM

ROCKY FLATS PLANT

GOLDEN, COLORADO

(intentionally blank)

TITLE: APPENDIX B

Approved By:

5/7/91
Director, Environmental Management

APPENDIX B

Table B1: Analytical Methods, Detection Limits, and Data Quality Objectives

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	BOREHOLE	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
INDICATORS									
Total Suspended Solids	EPA 160.2*	X**				10 mg/l	NA	20%RPD*	80-120% LCS Recovery
Total Dissolved Solids	EPA 160.1*	X	X*			5 mg/l	NA	20%RPD*	80-120% LCS Recovery
pH	EPA 150.1*	X**	X*			0.1 pH units	0.1 pH units	NA	±0.05 pH units
INORGANICS									
Target Analyte List - Metals		X*	X*	X	X			WATER/SOIL	WATER/SOIL
Aluminum	EPA CLP SOW					200 ug/L*	40 mg/Kg*	**	***
Antimony	EPA CLP SOW					60	12		
Arsenic (GFAA)	EPA CLP SOW					10	2		
Barium	EPA CLP SOW					200	40		
Beryllium	EPA CLP SOW					5	1.0		
Cadmium	EPA CLP SOW					5	1.0		
Calcium	EPA CLP SOW					5000	2000		
Chromium	EPA CLP SOW					10	2.0		
Cobalt	EPA CLP SOW					50	10		
Copper	EPA CLP SOW					25	5.0		
Cyanide	EPA 335.3 (modified for CLP)**					5	10		
Iron	EPA CLP SOW					100 ug/L*	20 mg/Kg*		
Lead (GFAA)	EPA CLP SOW					3	1.0		
Magnesium	EPA CLP SOW					5000	2000		
Manganese	EPA CLP SOW					15	3.0		
Mercury (CVAA)	EPA CLP SOW					0.2	0.2		
Nickel	EPA CLP SOW					40	8.0		
Potassium	EPA CLP SOW					5000	2000		
Selenium (GFAA)	EPA CLP SOW					5	1.0		
Silver	EPA CLP SOW					10	2.0		
Sodium	EPA CLP SOW					5000	2000		
Thallium (GFAA)	EPA CLP SOW					10	2.0		
Vanadium	EPA CLP SOW					50	10		
Zinc	EPA CLP SOW					20	4.0		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	BOREHOLE	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
Other Metals		X*	X*	X	X			WATER/SOIL	WATER/SOIL
Molybdenum	EPA CLP SOW (ICAP)					8 ug/L*	40 mg/Kg*	**	***
Cesium	EPA CLP SOW					1000	200		
Strontium	EPA CLP SOW					200	40		
Lithium	EPA CLP SOW					100	20		
Tin	EPA CLP SOW					200	40		
Other Inorganics									
Percent Solids	EPA 160.3*			X	X	NA	10 mg	NA	NA
Sulfide	EPA 376.1*			X	X	NA	4 ug/g	Same as metals	Same as metals
ANIONS								Water/Soil	Water/Soil
Carbonate	EPA 310.1*	X*	X*			10 mg/L	NA	Same as metals	Same as metals
Bicarbonate	EPA 310.1*	X*	X*			10 mg/L	NA		
Chloride	EPA 325.2*	X*	X*			5 mg/L	NA		
Sulfate	EPA 375.4*	X*	X*			5 mg/L	NA		
Nitrate as N	EPA 353.2* or 353.3*	X*	X*			1 mg/L	NA		
Fluoride	EPA 340.2*	X*	X*			5 mg/L	NA		
Oil and Grease	EPA 413.2*	X*				5 mg/L	NA	**	***
*Total Petroleum Hydrocarbons	EPA 418.1*			X	X	NA	10 mg/Kg	NA/40	NA/80-120
Target Compound List Volatiles	EPA CLP SOW	X*	X*	X	X			WATER/SOIL	WATER/SOIL
Chloromethane	EPA CLP SOW					10 ug/L	10 ug/Kg (low)*	**	***
Bromomethane	EPA CLP SOW					10	10		
Vinyl Chloride	EPA CLP SOW					10	10		
Chloroethane	EPA CLP SOW					10	10		
Methylene Chloride	EPA CLP SOW					5	5		
Acetone	EPA CLP SOW					10	10		
Carbon Disulfide	EPA CLP SOW					5	5		
1,1-Dichloroethene	EPA CLP SOW					5	5		
1,1-Dichororethane	EPA CLP SOW					5 ug/L	5 ug/Kg(low)*		
total 1,2-Dichloroethene	EPA CLP SOW					5	5		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	QW	BOREHOLE	SED	Required Detection Limits Water	Soil/Sed.	Precision Objective	Accuracy Objective
Target Compound List - Volatiles (continued)		X*	X*	X	X			WATER/SOIL	WATER/SOIL
Chloroform	EPA CLP SOW					5	5	**	***
1,2-Dichloroethane	EPA CLP SOW					1	5		
2-Butanone	EPA CLP SOW					10	10		
1,1,1-Trichoroethane	EPA CLP SOW					5	5		
Carbon Tetrachloride	EPA CLP SOW					5	5		
Vinyl Acetate	EPA CLP SOW					10	10		
Bromodichloromethane	EPA CLP SOW					5	5		
1,2-Dichloropropane	EPA CLP SOW					5	5		
cis-1,3-Dichloropropene	EPA CLP SOW					5	5		
Trichloroethene	EPA CLP SOW					5	5		
Dibromochloromethane	EPA CLP SOW					5	5		
1,1,2-Trichloroethane	EPA CLP SOW					5	5		
Benzene	EPA CLP SOW					5	5		
trans-1,2-Dichloropropene	EPA CLP SOW					5	5		
Bromoform	EPA CLP SOW					5	5		
4-Methyl-2-pentanone	EPA CLP SOW					10	10		
2-Hexanone	EPA CLP SOW					10	10		
Tetrachloroethene	EPA CLP SOW					5	5		
Toluene	EPA CLP SOW					5	5		
1,1,2,2-Tetrachoroethane	EPA CLP SOW					5	5		
Chlorobenzene	EPA CLP SOW					5	5		
Ethyl Benzene	EPA CLP SOW					5	5		
Styrene	EPA CLP SOW					5	5		
Total Xylenes	EPA CLP SOW					5	5		
Target Compound List - Semi-Volatiles			X*	X	X			WATER/SOIL	WATER/SOIL
Phenol	EPA CLP SOW					10 ug/l	330 ug/Kg*	**	***
bis(2-Chloroethyl)ether	EPA CLP SOW					10	330		
2-Chlorophenol	EPA CLP SOW					10	330		
1,3-Dichlorobenzene	EPA CLP SOW					10	330		
1,4-Dichlorobenzene	EPA CLP SOW					10	330		
Benzyl Alcohol	EPA CLP SOW					10	330		
1,2-Dichlorobenzene	EPA CLP SOW					10	330		
2-Methylphenol	EPA CLP SOW					10	330		
bis(2-Chloroisopropyl)ether	EPA CLP SOW					10	330		
4-Methylphenol	EPA CLP SOW					10	330		
N-Nitroso-Dipropylamine	EPA CLP SOW					10	330		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	CLP	BOREHOLE	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
Target Compound List - Semi-Volatiles (continued)			X	X	X			WATER/SOIL	WATER/SOIL
Hexachloroethane	EPA CLP SOW					10	330	..	...
Nitrobenzene	EPA CLP SOW					10	330		
Isophorone	EPA CLP SOW					10	330		
2-Nitrophenol	EPA CLP SOW					10	330		
2,4-Dimethylphenol	EPA CLP SOW					10	330		
Benzoic Acid	EPA CLP SOW					50	1600		
bis(2-Chloroethoxy)methane	EPA CLP SOW					10	330		
2,4-Dichlorophenol	EPA CLP SOW					10	330		
1,2,4-Trichlorobenzene	EPA CLP SOW					10	330		
Naphthalene	EPA CLP SOW					10	330		
4-Chloroaniline	EPA CLP SOW					10	330		
Hexachlorobutadiene	EPA CLP SOW					10	330		
4-Chloro-3-methylphenol	EPA CLP SOW					10	330		
2-Methylnaphthalene	EPA CLP SOW					10	330		
Hexachlorocyclopentadiene	EPA CLP SOW					10 ug/l	330 ug/Kg'		
2,4,6-Trichlorophenol	EPA CLP SOW					10	330		
2,4,5-Trichlorophenol	EPA CLP SOW					50	1600		
2-Chloronaphthalene	EPA CLP SOW					10	330		
2-Nitroaniline	EPA CLP SOW					50	1600		
Dimethylphthalate	EPA CLP SOW					10	330		
Acenaphthylene	EPA CLP SOW					10	330		
2,6-Dinitrotoluene	EPA CLP SOW					10	330		
3-Nitroaniline	EPA CLP SOW					50	1600		
Acenaphthene	EPA CLP SOW					10	330		
2,4-Dinitrophenol	EPA CLP SOW					50	1600		
4-Nitrophenol	EPA CLP SOW					50	1600		
Dibenzofuran	EPA CLP SOW					10	330		
2,4-Dinitrotoluene	EPA CLP SOW					10	330		
Diethylphthalate	EPA CLP SOW					10	330		
4-Chlorophenol Phenyl ether	EPA CLP SOW					10	330		
Fluorene	EPA CLP SOW					10	330		
4-Nitroaniline	EPA CLP SOW					50	1600		
4,6-Dinitro-2-methylphenol	EPA CLP SOW					50	1600		
N-nitrosodiphenylamine	EPA CLP SOW					10	330		
4-Bromophenyl Phenyl ether	EPA CLP SOW					10	330		
Hexachlorobenzene	EPA CLP SOW					10	330		
Pentachlorophenol	EPA CLP SOW					50	1600		
Phenanthrene	EPA CLP SOW					10	330		
Anthracene	EPA CLP SOW					10 ug/l	350 ug/Kg'		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	BOREHOLE	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
Target Compound List - Semi-Volatiles (continued)			X"	X	X			WATER/SOIL	WATER/SOIL
Di-n-butylphthalate	EPA CLP SOW					10	330	**	***
Fluoranthene	EPA CLP SOW					10	330		
Pyrene	EPA CLP SOW					10	330		
Butyl Benzylphthalate	EPA CLP SOW					10	330		
3,3'-Dichlorobenzidine	EPA CLP SOW					20	660		
Benzo(a)anthracene	EPA CLP SOW					10	330		
Chrysene	EPA CLP SOW					10	330		
bis(2-ethylhexyl)phthalate	EPA CLP SOW					10	330		
Di-n-octyl Phthalate	EPA CLP SOW					10	330		
Benzo(b)fluoranthene	EPA CLP SOW					10	330		
Benzo(k)fluoranthene	EPA CLP SOW					10	330		
Benzo(a)pyrene	EPA CLP SOW					10	330		
Indeno(1,2,3-cd)pyrene	EPA CLP SOW					10	330		
Dibenz(a,h)anthracene	EPA CLP SOW					10	330		
Benzo(g,h,i)perylene	EPA CLP SOW					10	330		
Target Compound List - Pesticides/PCBs			X"	X	X			WATER/SOIL (%RPD)	WATER/SOIL (% Recovery)
alpha-BHC	EPA CLP SOW					0.05 ug/L	8.0 ug/Kg'	**	***
beta-BHC	EPA CLP SOW					0.05	8.0		
delta-BHC	EPA CLP SOW					0.05	8.0		
gamma-BHC (Lindane)	EPA CLP SOW					0.05	8.0		
Heptachlor	EPA CLP SOW					0.05	8.0		
Aldrin	EPA CLP SOW					0.05 ug/L	8.0 ug/Kg'		
Heptachlor Epoxide	EPA CLP SOW					0.05	8.0		
Endosulfan I	EPA CLP SOW					0.05	8.0		
Dieldrin	EPA CLP SOW					0.10	16.0		
4,4'-DDE	EPA CLP SOW					0.10	16.0		
Endrin	EPA CLP SOW					0.10	16.0		
Endosulfan II	EPA CLP SOW					0.10	16.0		
4,4'-DDD	EPA CLP SOW					0.10	16.0		
Endosulfan Sulfate	EPA CLP SOW					0.10	16.0		
4,4'-DDT	EPA CLP SOW					0.10	16.0		
Methoxychlor	EPA CLP SOW					0.5	80.0		
Endrin Ketone	EPA CLP SOW					0.10	16.0		
alpha-Chlordane	EPA CLP SOW					0.5	80.0		
gamma-Chlordane	EPA CLP SOW					0.5	80.0		
Toxaphene	EPA CLP SOW					1.0	160.0		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	BOREHOLE	SED	Required Detection Limits Water	Soil/Sed.	Precision Objective	Accuracy Objective
Target Compound List - Pesticides/PCBs (continued)			X	X	X			WATER/SOIL (%RPD)	WATER/SOIL (% Recovery)
AROCLOR-1016	EPA CLP SOW					0.5	80.0		
AROCLOR-1221	EPA CLP SOW					0.5	80.0		
AROCLOR-1232	EPA CLP SOW					0.5	80.0		
AROCLOR-1242	EPA CLP SOW					0.5	80.0		
AROCLOR-1248	EPA CLP SOW					0.5	80.0		
AROCLOR-1254	EPA CLP SOW					1.0	160.0		
AROCLOR-1260	EPA CLP SOW					1.0	160.0		
RADIONUCLIDES								(Replicate Analyses)	(Laboratory Control Sample)
Gross Alpha	f,g,h,i,k,l,m,n,s	X'-"	X'	X	X	4 pCi/L	4 pCi/g	**	***
Gross Beta	f,g,h,i,k,l,m,n,s	X'-"	X'	X	X	4 pCi/L	10 pCi/g		
Uranium 233+234	f,h,i,m,l,n,s	X'-"	X'	X	X	0.6 pCi/L	0.3 pCi/g		
Uranium 235,238	f,h,i,l,m,n,s	X'-"	X'	X	X	0.6 pCi/L	0.3 pCi/g		
Americium 241	i,l,p,q,s	X'-"	X'	X	X	0.01 pCi/L	0.02 pCi/g		
Plutonium 239+240	i,l,o,p,s	X'-"	X'	X	X	0.01 pCi/L	0.03 pCi/g		
Tritium	f,g,h,i,l,m,s	X"	X"	X	X	400 pCi/L	400 pCi/L		
Strontium 89,90	f,h,i,l,m,s			X	X	NA	1 pCi/g		
Strontium 90 only	f,h,i,l,m,s	X'-"	X'			1 pCi/L	NA		
Cesium 137	h,i,l,m	X'-"	X'	X	X	1 pCi/L	0.1 pCi/g		
Radium 226	f,g,h,i,l,m',s	X'-"	X'			0.5 pCi/L	0.5 pCi/g		
Radium 228	f,g,h,i,l,m',s	X'-"	X'			1 pCi/L	0.5 pCi/g		
SURFICIAL SOIL SAMPLING PARAMETERS									
Total Organic Carbon	ALPHA 5310'						1 mg/kg	**	***
Carbonate	EPA 310.1'						2 mg/kg		
pH	EPA 150.1'						0.1 pH units		
Specific Conductance	EPA 120.1'						2.5 umho/cm		
Plutonium 239+240	i,l,o,p,s						0.03 pCi/g		
Americium 241	i,l,p,q,s						0.01 pCi/g		
Uranium 233,234,235,238	f,h,i,l,m,n,s						0.06 pCi/g		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	BOREHOLE	SED	Reproducibility Objective	Accuracy
FIELD PARAMETERS							
pH	1	X	X			± 0.1 pH unit	± 0.2 pH units
Specific Conductance	1	X	X			2.5 umho/cm 25 umho/cm 250 umho/cm	± 2.5% max. error at 500, 5000, 50000 umhos/cm plus probe; ± 3.0% max error at 250, 2500, and 25000 plus probe accuracy of ± 2.0%.
Temperature	1	X	X			± 0.1°C	± 1.0°C
Dissolved Oxygen	1	X				± 0.1 mg/L	± 10%

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

* For samples collected from IHSSs 102 and 105 only (BH01,BH02,BH03,BH04,BH05,BH06,BH07,BH08 (MW33),BH09,BH15,BH16,BH17,BH18,MW01,MW02,MW03,MW33 (BH08)).
** Precision objective = control limits specified in referenced method and/or Data Validation Guidelines.
*** Accuracy objective = control limits specified in referenced method (in GRRASP for radionuclides).
F = Filtered
U = Unfiltered

1. Measured in the field in accordance with instrument manufacturer's instructions. The instruments to be used are specified in Section 12.
2. Medium soil/sediment required detection limits for pesticide/PCB TCL compounds are 15 times the individual low soil/sediment required detection limit.
3. Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.
4. Higher detection limits may only be used in the following circumstance: If the sample concentration exceeds five times the detection limit of the instrument or method in use, the value may be reported even though the instrument or method detection limit may not equal the required detection limit. This is illustrated in the example below:

   For lead:

   Method in use - ICP
   Instrument Detection Limit (IDL) - 40
   Sample Concentration - 220
   Required Detection Limit (RDL) - 3

   The value of 220 may be reported even though the instrument detection limit is greater than the RDL.

   Note: The specified detection limits are based on a pure water matrix. The detection limits for samples may be considerably higher depending on the sample matrix.
5. If gross alpha > 5 pCi/L, analyze for Radium 226; if Radium 226 > 3 pCi/L, analyze for Radium 228.
6. The detection limits presented were calculated using the formula in N.R.C. Regulatory Guide 4.16, Appendix, Lower Limit of Detection, pg. 21, and follow:

$$LLD = \frac{4.66\ (BKG/BKG\ DUR)^{1/2}}{(2.22)(Eff)(CR)(SR)(e^{-\lambda t})(Aliq)}$$

$$MDA = \frac{4.66\ (BKG/Sample\ DUR)^{1/2}}{(2.22)(Eff)(CR)(SR)e^{-\lambda t}(Aliq)}$$

Where:

LLD = Lower Limit of Detection in pCi per sample unit.
BKG = Instrument Background in counts per minute (CPM).
Eff = Counting efficiency in cpm/disintegration per minute (dpm).
CR = Fractional radiochemical yield.
SR = Fractional radiochemical yield of a known solution.
λ = The radioactive decay constant for the particular radionuclide.
t = The elapsed time between sample collection and counting.
Aliq = Sample volume.
BKG DUR = Background count duration in minutes.

MDA = Minimum Detectable Activity in pCi per sample unit
BKG = same as for LLD
Eff = same as for LLD
CR = same as for LLD
SR = same as for LLD
λ = same as for LLD
t = same as for LLD
Aliq = same as for LLD
Sample DUR = sample count duration in minutes

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

7. On 500 umho/cm range.
8. On 5000 umho/cm range.
9. On 50000 umho/cm range.

a. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, 7/88 (or latest version).
b. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, 7/88 (or latest version). The specific method to be utilized is at the laboratory's discretion provided it meets the specified detection limit.
c. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, 2/88 (or latest version).
d. Methods are from "Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, 1983, unless otherwise indicated.
e. Methods are from "Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods," (SW-846, 3rd Ed.), U.S. Environmental Protection Agency.
f. U.S. Environmental Protection Agency, 1979, Radiochemical Analytical Procedures for Analysis of Environmental Samples, Report No. EMSL-LV-0539-1, Las Vegas, NV, U.S. Environmental Protection Agency.
g. American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985. Standard Methods for the Examination of Water and Wastewater, 16th ed., Washington, D.C., Am. Public Health Association.
h. U.S. Environmental Protection Agency, 1976. Interim Radiochemical Methodology for Drinking Water, Report No. EPA-600/4-75-008. Cincinnati U.S. Environmental Protection Agency.
i. Harley, J.H., ed., 1975, ASL Procedures Manual, HASL-300; Washington, D.C., U.S. Energy Research and Development Administration.
j. U.S. EPA, 1982. "Methods for Organic Analysis of Municipal and Industrial Waste Water," US EPA-600/4-82-057.
k. "Handbook of Analytical Procedures," USAEC, Grand Junction Lab. 1970, page 196.
l. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA-600/4-80-032, August 1980, Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.
m. "Methods for Determination of Radioactive Substances in Water and Fluvial Sediments," U.S.G.S. Book 5, Chapter A5, 1977.
n. "Acid Dissolution Method for the Analysis of Plutonium in Soil," EPA-600/7-79-081, March 1979, U.S. EPA Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, 1979.
o. "Procedures for the Isolation of Alpha Spectrometrically Pure Plutonium, Uranium, and Americium," by E.H. Essington and B.J. Drennon, Los Alamos National Laboratory, a private communication.
p. "Isolation of Americium from Urine Samples," Rocky Flats Plant, Health, Safety, and Environmental Laboratories.
q. "Radioactivity in Drinking Water," EPA 570/9-81-002.
r. If the sample or duplicate result is <5 x IDL, then the control limit is ± IDL.
s. U.S. EPA, 1987. "Eastern Environmental Radiation Facility Radiochemistry Procedures Manual," EPA-520/5-84-006.

APPENDIX 3.2
INDUSTRIAL AREA IM/IRA/DD
LIST II FOR
AIR INHALATION PATHWAY

(intentionally blank)

List II - Potential Contaminants of Concerns for Air Pathway

Attachment A.1.2

Taken from the *Plan for the Prevention of Contaminant Dispersion* (DOE 1991a)

(intentionally blank)

PRINCIPAL CONTAMINANTS – METALS/INORGANICS

	Information Source	Inh RfC (s) (mg/kg/day)	Inh SF (mg/kg/day)$^{-1}$
Arsenic	a,b	--------	0.5
Barium	a,b	0.001	--------
Beryllium	b	--------	8.4
Cadmium	b	--------	6.1
Chromium III	b	5.70E−06	--------
Chromium VI	b	5.70E−06	0.012
Manganese	a,b	1.14E−04	--------
Mercury	b	8.60E−05	--------

PRINCIPAL CONTAMINANTS – RADIONUCLIDES

	Information Source	Inhalation (pCi)$^{-1}$
Uranium 233 + 234	b	2.70E−08
Uranium 235	b	2.50E−08
Uranium 238	b	2.40E−08
Americium 241	b	4.00E−08
Plutonium 239 + 240	b	4.10E−08
Tritium (gas)	b	7.80E−14
Strontium 89 + 90	b	2.90E−12
Strontium 90	b	5.80E−11
Cesium 137	b	5.00E−10
Radium 226	b	8.10E−08
Radium 228	b	1.80E−08

PRINCIPAL CONTAMINANTS – VOLATILE ORGANICS

	Information Source	Inh RfC (s) (mg/kg/day)	Inh SF (mg/kg/day)$^{-1}$
Chloroform	a,b	--------	0.081
1,1,1-Trichloroethane	b	3	--------
Carbon Tetrachloride	b	--------	0.13
Benzene	a,b	--------	0.29
Toluene	a,b	0.8	--------
Dichloromethane (Methylene Chloride)	a,b	0.9	0.0002
Xylenes	a,b	0.09	--------
Methyl Ethyl Ketone (2-Butanone)	a,b	0.9	--------
1,2-Dichloroethane	a,b	--------	0.091
Bromomethane	a,b	0.2	--------
Carbon Disulfide	a,b	0.003	--------
1,1-Dichloroethene	a,b	--------	1.2
1,1-Dichloroethane	b	1	--------
Vinyl Acetate	a,b	0.06	--------
1,3-Dichloropropene	a,b	0.06	0.13
1,1,2-Trichloroethane	b	--------	0.057
Bromoform	a,b	--------	0.0039
Tetrachloroethene	b	--------	0.018
Chlorobenzene	a,b	0.05	--------
Ethylbenzene	a,b	0.3	--------
Styrene	a,b	--------	0.03
Vinyl Chloride	a,b	--------	0.029
1,2-Dichloroethene	a,b	--------	0.091
1,2-Dichloropropane	a,b	--------	0.13
1,1,2,2,-Tetrachloroethane	a,b	--------	0.2

PRINCIPAL CONTAMINANTS – SEMIVOLATILE ORGANICS

	Information Source	Inh RfC (s) (mg/kg/day)	Inh SF (mg/kg/day)$^{-1}$
bis(2-chloroethyl)ether	a,b	--------	1.1
1,4-Dichlorobenzene	a,b	0.7	--------
1,2-Dichlorobenzene	a,b	2	--------
Nitrobenzene	a,b	0.02	--------
Hexachloroethane	a,b	--------	0.014
1,2,4-Trichlorobenzene	b	0.03	--------
Hexachlorobutadiene	a,b	--------	0.078
Hexachlorocyclopentadiene	a,b	0.0007	--------
2,4,6-Trichlorophenol	a,b	--------	0.011
Hexachlorobenzene	a,b	--------	1.6

a – Integrated Risk Information System
b – Health Effects Assessment Summary Tables

PRINCIPAL CONTAMINANTS - PESTICIDES/PCBs

	Information Source	Inh RfC (s) (mg/kg/day)	Inh SF (mg/kg/day)$^{-1}$
Hexachlorocyclohexane (alpha)	IRIS	--------	6.3
Hexachlorocyclohexane (beta)	IRIS	--------	1.8
Heptachlor	IRIS	--------	4.5
Heptachlor Epoxide	IRIS	--------	9.1
Aldrin	IRIS	--------	17
Dieldrin	IRIS	--------	1.6
DDT	IRIS	--------	0.34
Chlordane (alpha, gamma)	IRIS	--------	1.3
Toxaphene	IRIS	--------	1.1

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL
HAZARDOUS SUBSTANCE SITES AND LOCATIONS

(intentionally blank)

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
4	101	Central portion of RFP inside the PA	Liquids and sludges: Pu, Am, tritium, U, Be, Cd, Cr, Ni and nitrates. Soils: metals, nitrate, K, Na, Ca, Mg, and radionuclides. Bedrock groundwater: nitrates and radionuclides. Surface water (seeps): nitrate, metals and radionuclides. Organic chemicals have been reported near detection limits in water samples from the ITS.
8	118.1	West of Building 730	A 20- by 40-foot area near a former UST containing carbon tetrachloride or trichloroethene west of Building 730.
8	118.2	South end of Building 77	A 20- by 30-foot area between Buildings 707 and 778, a carbon tetrachloride spill. (Organic solvents [ERTSD].)
8	123.1	Valve Vault 7 southwest of Building 707	A 40- by 40-foot area south of Sage Avenue and west of North Street. A process wastewater spill, containing uranium solvents, oils, beryllium, nitric acid, hydrochloric acid and fluoride.
8	135	Cooling Tower Blowdown Northeast of Building 374	A 115- by 40- by 50-foot area northeast of Building 374. Possible tritium contamination from cooling tower blowdown water.
8	137	Cooling Tower Blowdown Buildings 712 and 713	A 10-foot wide zone beyond the foundations of Buildings 712 and 713 possible contamination from cooling tower blowdown water contaminated with chromates.
8	138	Cooling Tower Blowdown near Building 779	A 50- by 50-foot area north of Building 727. A pipe leak and effluent spill toward trench 6, possible chromium and radiation activity.*

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
8	139.1 (North & South)	Hydroxide Tank Area Buildings 771 and 774	NaOH steam condensate tanks and KOH tank, possible chromium and 3,000 disintegrations per minute per liter alpha activity. (HCl, HF, HNO_3, H_2SO4, NaOH, [ERTSD].)*
8	139.2	Hydrofluoric acid Tank Area - Building 174	Possible spill from horizontal 1,300-pound hydrofluoric acid cylinders.*
8	144	Sewer Line Breaks near Building 730, Tanks 776 A-D	Four underground waste holding tanks north of Building 776 and east of Building 70/A. Possible elevated radioactivity.
8	150.1	Radioactive site north of Building 771	Radioactive waste leaks north of Buildings 771 and 776.*
8	150.2	Radioactive site west of Buildings 771 and 776	From the 1957 fire in Building 771. Water from the fire fighting contaminated soil west of Buildings 771 (plutonium).*
8	150.3	Radioactive site west of Buildings 771 and 774	Radioactive leak from process waste lines into a tunnel that connects Buildings 771 and 774, could have also contained nitrates, and other chemical contaminants.
8	150.4	Radioactive site east of Building 750	Leaking process waste line near a sump located outside Door 3 south of Building 778. There is a possibility that decontamination of equipment occurred in the area after 1969 fire, probably contaminated with plutonium.
8	150.5	Radioactive site west of Building 707	Documented releases from overflow of Valve Vault 7 and an original process waste line (OPWL) valve vault removed in March 1973. U, solvents, oils, Be,N_2NO_3, HCl and Fluoride.*

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
8	150.6	Radioactive site south of Building 779	Contaminated oil from a cut-apart drum was tracked by pedestrians to the first floor dock and surrounding outdoor areas south and east of Building 779.
8	150.7	Radioactive site south of Building 776	From 1969 fire, plutonium tracked outside Building 776 by fire fighting.
8	150.8	Radioactive site south of Building 779	An improperly opened, radioactively contaminated waste drum was spread by pedestrian tracking.*
8	151	Fuel oil leak - Tank 262 north of Building 374	UST No. 2 diesel fuel oil a 45- by 60-foot area centered over tank.*
8	163.1	Radioactive site north of Building 774	A 50- by 125-foot area northwest of Building 774. Reportedly, area used to wash radioactive-contaminated vehicles. (Am [ERTSD]).*
8	163.2	Radioactive site north of Buildings 771 and 774	An 8- by 8-foot slab buried near Building 771A. Slab used as a foundation for a 5,000-gallon stainless steel tank used in the filtrate recovery ion exchange system. (Am [EG&G 1992g]).*
8	172	Central Avenue Waste Spill	Approximately 1 mile of Central Avenue from 903 Pad to Building 771. A drum of contaminated lathe coolant leaked during its transport to the waste treatment facility. Possibly carbon tetrachloride and machine cutting oil, percholoroethylene, uranium, and plutonium.*

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
8	173	Radioactive site 900 Area, dock area, Building 991	Activities at the dock included cleaning of depleted uranium parts with acetone, perchloroethene, and trichloroethane. (Am [ERTSD].)*
8	184	Radioactive site Building 991 Steam Cleaning Area (near Building 992)	A 55- by 75-foot area located south of Building 991 used to steam clean radioactively contaminated equipment and drums.
8	188	Acid leak, the southeast corner of Building 374	A 55-gallon drum containing nitric and hydrochloric acid leaked. The mixture was suspected to be a waste leaching solution originating from the 400 Area, which may have contained trace heavy metals.
9	121	OPWL. A network of pipelines and tanks that extends throughout much of the RFP main production complex. It is 35,000 feet of underground pipelines and 39 tank locations for a total of 65 tanks.	Used to transport and temporarily store process wastes to onsite treatment and discharge points. Potential contaminants include uranium 238 and 235, plutonium, nitrate, acids, bases, hexavalent chromium, beryllium, iron, iodine, phosphate, tritium.*
9	122	Underground Storage Tanks South of Building 441	Tanks stored process waste from Buildings 441 and 123. Nitrates and radionuclides would be present.
9	123.2	Valve Vault West of Building 707	A liquid release containing uranium, solvents, oil, beryllium, nitric and hydrochloric acids, and fluoride.

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
9	124.1 124.2	Three tanks east of Building 774	A release of process wastewater, high in nitrate and contaminated with plutonium and uranium. (Metals [ERTSD].)
9	124.3	Three tanks east of Building 774	A release of process wastewater, high in nitrate and contaminated with plutonium and uranium.
9	125	Holding tank east of Building 774	A release of process wastewater, high in nitrate and contaminated with plutonium and possibly uranium.
9	126.1	Out-of-service process waste tanks in Building 728	A release of liquid process wastes contaminated with nitrate, plutonium, uranium, and various other organic and inorganic constituents.
9	126.2	Out-of-service process waste tanks in Building 728	A release of liquid process wastes contaminated with nitrate, plutonium, uranium, and various other organic and inorganic constituents.
9	127	Process waste line between Building 774 and the sanitary wastewater treatment plant	Numerous line breaks. The waste is characterized by high nitrate levels with plutonium contamination.
9	132	Underground storage tanks under Building 730	Leaking underground storage tanks, containing mostly water with small amounts of detergent and radionuclides.
9	146.1	Six underground concrete process waste holding tanks south of the original Building 774	The process waste stored in the tanks was an aqueous solution with plutonium, uranium, acids, and caustics.

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
9	146.6	Six underground concrete process waste holding tanks south of the original Building 774	The process waste stored in the tanks was an aqueous solution with plutonium, uranium, acids, and caustics.
9	147.1	Process waste line north of Building 881	High nitrate levels, uranium, plutonium, beryllium, acids, and solvents.*
9	149.1	Two PVC pipes between Building 774 and the 207 Solar Evaporation Ponds	Low-level radioactive wastes containing caustics and acids.
9	149.2	Two PVC pipes between Building 774 and the 207 Solar Evaporation Ponds	Low-level radioactive wastes containing caustics and acids.
9	159	Radioactive site Building 559	Process waste consisting of and aqueous solution with radioactive constituents.
9	215	A concrete mixed waste storage tank near Building 771	The tank held sludge from second stage precipitation of liquid process waste from Building 771, and silver effluent from Building 774.
10	129	Approximately 25 feet east of Building 443	Underground fuel oil tank and ancillary piping. Also stored #2 diesel, wastewater and compressor oil, solvents, and trace amounts of 1,1,1-trichloroethane. (Hg, Cd, Cu, Pb [ERTSD].)

OU	IHSS	LOCATION	DESCRIPTION
10	170	Property Utilization and Disposal Storage Yard. Approx. 260- by 1,000-foot area, southeast of the Present Landfill	Area used to store various containers that contained waste oils and spent solvents.
10	174	A 60- by 60-foot area near the northeast corner, and a 20- by 40-foot area along the northern fence line, of the Property Utilization and Disposal Storage Yard	Area used to store drums of maintenance and fabrication shops waste liquids, waste paints, waste paint thinner, stainless steel chips coated with freon-based or oil-based lathe coolant. (Metals, nitrates and radionuclides [ERTSD].)
10	175	A 25- by 25-foot area in the eastern third of a storage yard south of Building 980	Area used to store drums of maintenance and fabrication shops waste liquids. Generally, drums contained waste oils and thinners. (Metals, radionuclides [ERTSD].)
10	176	Swiggerton & Walberg Contractor Storage Yard. A 290- by 390-foot area, approximately 50 feet east of solar evaporation ponds, in vicinity of Building 964	Containers stored intermittently throughout area, including mineral spirits, waste oil, volatile organic compounds and metals. Low level radioactivity has also been detected. (Nitrates, radionuclides [ERTSD].)
10	177	Two 10- by 20-foot areas in the eastern and western sections respectively, of Building 885	Drum storage areas. Western area stored unused and waste oils. Eastern area stored unused and waste paint and paint solvents. Waste materials also contained low-level radioactive wastes.

OU	IHSS	LOCATION	DESCRIPTION
10	181	Small portion of parking lot north of Building 334	Former location of 8- by 20-foot cargo container used to store drums of machine oils, solvents, coolants and possibly low-level radioactive wastes.*
10	182	An approx. 1,700-square-foot area between Buildings 444 and 453	A drum storage area. Drums contained waste hydraulic oils and chlorinated solvents. Beryllium and low-level depleted uranium oxide waste contamination present in some of the waste.
10	205	Outside of Building 460, along southeast corner of the building	Portable cylindrical vessels used to collect waste nitric acid, hydrofluoric acid, and ammonium salts.
10	206	East side of Building 374	Area where an 8-foot-diameter by 49.5-foot-long steel storage tank was located. Tank stored off-specification Building 374 product water. Water contained low concentrations of tritium.*
10	207	A 9.5- by 9-foot area at the east side of Building 444	Bermed area that contained acid waste dumpsters. Acids were a mixture of phosphoric acid, sulfuric acid and chromium trioxide. Waste acid contained cyanide, cadmium chromium, lead, silver, arsenic, uranium, americium, and tritium contamination. Dumpsters have been removed.
10	208	Approximately 30 feet west of Building 453	An 8- by 20-foot cargo container. Wastes stored were a composite of nitric acid with silver, sodium fluoride, sodium fluoride solution, plating acids (hydrochloric, nitric, hydrofluoric) with chromium plating solution, cadmium cyanide solution, nickel sulfate, developer, and fixer.

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
10	210	South of Spruce Avenue and east of 10th Street, approx. 40 feet south of Building 980	An 8- by 20-foot cargo container and adjacent 20- by 20-foot area used to store drums of waste auto oil, solvents, paints, thinner, grease, gasoline, diesel fuel, and fiberglass resins and catalysts.
10	213	Southeastern portion of the production area	A 439- by 295-foot area covered with asphalt. Used to store pondcrete; a mixture of Solar Evaporation Pond sludge and sediment with portland cement. Potential contamination by nitrate, low-level radiation, and volatile organic compounds.
10	214	Approx. 90 feet east of Building 750	A 142,000-square-foot area covered with asphalt. Used to store pondcrete; a mixture of Solar Evaporation Pond sludge and sediment with portland cement. Solidified low-level radioactive and hazardous wastes.
12	116.1	West Loading Dock Building 447	Spills and leaks from oil stored in drums. Suspected solvents and hydrocarbons, may also be low-level radioactive materials.
12	116.2	South Loading Dock Building 444	Many incidents of drum leakage and spills. Contaminants include uranium, uranium oxide, tetrachloride, nitric acid, chlorinated hydrocarbon solvents, and beryllium. Beryllium soil concentrations range from 350 to 1,000 micrograms per gram. Direct uranium activity readings were recorded as high as 7,500 disintegrations per minute. Direct uranium air counts have been recorded as high as 1,372 disintegrations per minute.

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
12	136.1	Cooling Tower Pond east of Building 444	Used to collect solutions used to clean the cooling towers, reportedly acidic or lithium dichromate, lithium chromate and hexavalent chromium. Small amounts of depleted uranium may have been buried here as well.
12	136.2 136.3	Cooling Tower Pond east of Building 444	Used to collect solutions used to clean the cooling towers, reportedly acidic or lithium dichromate, lithium chromate and hexavalent chromium. Small amounts of depleted uranium may have been buried here as well.
12	157.2	Radioactive site south Area Building 444, 447, 440 and 439	Several incidents of spills and fires, contaminated soils around these buildings, including depleted and enriched uranium, beryllium, chlorinated hydrocarbon solvents, including carbon tetrachloride, hydraulic oil, lithium, and chromium. (Pu may be present [ERTSD].)*
12	187	Sulfuric Acid Spill east of Building 4433	1,500 gallons of 94 percent sulfuric acid spilled from an aboveground storage tank. 32,000 pounds of lime were added to neutralize the acid. In addition, 200 additional gallons went to the sewer system.
12	120.1	Fiberglassing Area north of Building 664	Spills of polyester resin peroxide catalyst materials and unspecified cleaning solvents. Higher than background levels of gamma radiation from plutonium, uranium, and americium have been detected.

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
12	120.2	Fiberglassing Area west of Building 664	Potential residue from spills of polyester resin peroxide catalyst and unspecified cleaning solvents. Higher than background levels of radiation from plutonium and uranium.
12	189	Nitric Acid Tanks north and west of Building 881	Three nitric acid spills. Two of the spills were neutralized with sodium bicarbonate.
12	147.2	Building 881 Conversion Activity, 150 feet south of Building 865, 250 feet east of Building 883 and 450 feet south of Central Avenue	Storage of equipment during conversion process. Beryllium and enriched or depleted uranium.
13	117.1	North Chemical Storage Site, northeast of Building 552, west of Building 559	Buried nonradioactive material including aluminum machine turnings, rings, shapes, overlays and other metal parts, contaminated with uranium chips.*
13	117.2	Middle Chemical Storage Site, east of Building 551	Multipurpose storage, including acids, soaps, solvents, beryllium chips and turnings, drums of aluminum scraps and drums of aluminum nitrate. Monitoring indicated occasional buildup of radioactivity.
13	117.3	South Chemical Storage Site, southwest corner of Central Avenue and Seventh Street	A wooden waste box containing a glovebox that leaked contaminated oil. Probably plutonium contaminated.
13	128	Oil Burn Pit No. 1 Waste Leak, north of Building 335	Experimental oil burning in a pit now buried. Reportedly 200 gallons of what is suspected to have been perchloroethene containing depleted uranium.

OU	IHSS	LOCATION	DESCRIPTION
13	134	Lithium Metal Destruction Site, beneath an eastern addition of Building 331 and Sage Avenue	Waste lithium mixed with machinery oils was burned in 55-gallon drums for the fire department training. Sodium, calcium, solvent-type chemical compounds; graphite; and magnesium may also have been present.
13	148	Waste Spills outside Building 123	Small spills of nitrate-bearing wastes. Leaks from process waste lines. Possible low-level radioactive wastes, with nitrates.
13	152	Fuel Oil Tank east of Building 452	No. 6 fuel oil spills and leaks.
13	157.1	North Area Radioactive Site, Building 444	Leak of spills from laundry operations, levels of radioactivity in soils range from 1.8×10^4 to 5.2×10^5 disintegrations per minute per kilogram. Contaminants include depleted uranium, enriched uranium, beryllium, and solvents. (Pu may be present [ERTSD].)*
13	158	Building 551 Radioactive Site	Laundry dock, storage area for offsite shipment by train. Low-level radioactive contamination from uranium.
13	169	Waste Peroxide Drum Burial, Chemical Storage Area east of Building 551	Spill of 35 percent hydrogen peroxide.
13	171	Solvent Burning Ground east of Building 335	Diesel fuel and gasoline burned and extinguished for training purposes, magnesium may also be present. Waste solvents may also have been present.

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
13	186	Valve Vault west of Building 552	Pipe leak - uranium nitrate, plutonium, americium, chloride and sulfate, and oakite.
13	190	Caustic Leak southeast corner of Building 443	A 1,500-gallon sodium hydroxide spill.*
13	191	Hydrogen Peroxide Spill near the intersection of Fifth Street and Central Avenue	Two 55-gallon drums of 35 percent hydrogen peroxide fell from a pallet.*
14	131	Radioactive Site 700 Area Site No. 1, Building 776 gas bottle dock	Explosion that released plutonium. (Small amount of U [ERTSD].)
14	156.1	Radioactive Site Building 334 Parking Lot	Contaminated soil pile - subsequently removed. Before removal, soil samples were 3 to 704 disintegrations per minute per gram.*
14	160	Radioactive Site Building 444 Parking Lot	Storage area for punctured or leaking waste drums and boxes. Uranium, plutonium, PCBs, tetrachloroethylene, carbon disulfide, and 1,1,1-trichloroethene.
14	161	Radioactive Site Area west of Building 664	Punctured or leaking drums and boxes. Americium-241, plutonium, uranium, hydraulic oil, tetrachloroethylene, and other volatile organics.
14	162	Radioactive Site 700 Area Site No. 2 south of Building 771	Unknown source - volatile organics, radionuclides, beryllium, iron, chromium, hexavalent chromium, nitric acid, hydrochloric acid, and fluoride.*

OU	IHSS	LOCATION	DESCRIPTION
14	164.1	Radioactive Site 800 Area, No. 2. Concrete Slab, northwest Building 881	Storage of a plutonium-contaminated slab.
14	164.2	Radioactive Site 800 Area, Site No. 2 Building 886 Spills	Spills as a result of movement of contaminated equipment and other activities. Accumulated groundwater in pit is likely uranium-contaminated.
14	164.3	Radioactive Site 800 Area Site No. 2 Buildings 889 Storage	Decontamination facility for uranium-contaminated equipment.
15	178	Building 881 Drum Storage Area	A 5- by 5-foot area located in Room 165, first used in the mid-1950s and is still used for less than 90-day storage. 55-gallon drums containing waste oil that contains hazardous (such as volatile organic compounds) and possibly low-level radioactive wastes have been stored here (ERTSD).*
15	179	Building 865 Drum Storage Area	An 8- by 12-foot area located in Room 145, first used in 1970 and is currently a 90-day accumulation area. 55-gallon drums containing waste oils, chlorinated solvents, and possibly beryllium have been stored here (ERTSD).*
15	180	Building 883 Drum Storage Area	A 10- by 16-foot area located in Room 104, used since 1981 and is currently used for a less than 90-day storage area. 55-gallon drums containing waste oils contaminated with solvents and uranium have been stored here (ERTSD).*
15	204	Original Uranium Chip Roaster	No Information

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
15	211	Unit 26, Building 881 Drum Storage Area	No Information
15	212	Unit 63, Building 371 Drum Storage	No Information
15	217	Unit 32, Building 881 Cyanide Bench Scale Treatment	No Information
16	185	Southeast loading dock of Building 707	A 30- by 60-foot area of a 1,1,1-trichloroethane spill from a fork-lift punctured 55-gallon drum (ERTSD).*
16	192	Floor drain of Building 708	An antifreeze discharge from 155 gallons of 25 percent ethylene glycol released from a chiller unit into a floor drain in December 1980. The floor was contained by diverting the storm water discharge into Pond B-1 (ERTSD).*
16	193	400 Area near Building 443	Steam condensate leak containing a low concentration of amines (ERTSD).
16	194	700 Area near Building 707	Steam condensate line break near Building 707. Water from this line flowed through Pond B-4 into Walnut Creek (ERTSD).*
16	195	Onsite south of Lindsay Ranch, northeast of RFP Production area	Cylinders of nickel carbonyl were lowered down a drilled hole where the nickel carbonyl was destroyed. Two cylinders where wedged in the hole and buried in place (ERTSD).

APPENDIX 3.3
INDUSTRIAL AREA IM/IRA/DD
SUMMARY OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES
LOCATION AND HAZARD SUMMARY BY IHSS

OU	IHSS	LOCATION	DESCRIPTION
16	196	Southside of Building 124	Backwash from the raw water treatment plant was collected in the unlined pond during the early 1900s. The pond was reported dried up and destroyed in the late 1970s. The area is now paved (ERTSD).
16	197	Southwest of Building 559	Two scrap metal sites used to dispose of nonradioactive, nonhazardous, nonprecious scrap metal. One site may have received used transformers that contained PCBs (ERTSD).

Notes: * See also PCB Sites Table.
Information from: *Integrated Field Sampling Plan* (Jacobs 1993a); *Historical Release Report* (EG&G 1992f); *Environmental Restoration Technical Support Document (ERTSD)* (EG&G 1992g).

APPENDIX 3.4
INDUSTRIAL AREA IM/IRA/DD
POLYCHLORINATED BIPHENYL SITES

(intentionally blank)

INDUSTRIAL AREA IM/IRA/DD
PCB SITES

PCB Site	IHSS	LOCATION	DESCRIPTION	CATEGORY
1	203	Near present landfill (not in IA)	55-gallon drums of PCBs were stored here. A spill occurred in this area. An unspecified amount of soil was excavated after the spill.	I
2	117.1	Adjacent to Bldg. 548 and 223	Two transformers (223-1 and 223-2) once leaked small amounts of oil before 1987.	II
3	Near 158 and 117.2	Adjacent to Bldg. 551	Transformer T556 was retrofilled in 1987. It is known to have leaked in the past. Stains on the pool and fresh oil present inside the east panel indicate that it is still leaking.	II
4	Near 181, 156.1, 190, and 191	NW of Bldg. 334	Transformer 334-1. No spills or leaks are known to have occurred.	III
5	Near 157.1 and 191	NE corner of Bldg. 443	Transformer 443-1 replaced a former leaking transformer in area.	II
6	-	Basement of Bldg. 111	Transformer was documented as having leaked before 1987. A drain system within the bermed transformer was sealed in 1987.	II
7	Near 157.2 and 136.2	NW of Bldg. 444	Transformer 444-2. No spills or leaks documented.	III
8	-	Basement of Bldg. 444	There are three drains in the area of the documented spill. One drain has been cemented over.	II

INDUSTRIAL AREA IM/IRA/DD
PCB SITES

PCB Site	IHSS	LOCATION	DESCRIPTION	CATEGORY
9	157.2	Bldg. 447 Roof	Area may have been impacted by surface water runoff contaminated with PCBs. Discharge may have contaminated roof areas, ground, and storm/sewer drains.	II
10	Near 172 and 190	N of 555-558 Substation	Leak around valve of Tranformer 558.	II
11	Near 172 and 190	S of 555-558 Substation	Transformer 555. No spills or leaks are known to have occurred. It is believed to have been retrofilled in 1987.	III
12	Near 172	N of Substation 661-675	Transformer 350-002 shows visible evidence of a leak from a valve on North side. Sample results dated 8/11/91 show high levels (22.49 pCi/g) of plutonium 239/240.	II
13	-	S of 661-675 Substation	Historical records indicate that the transformer leaked before 1987. The transformer was retrofilled in 1987.	II
14	Near 121	Adjacent to Bldg. 666	Area was used to store unused and unusable transformers. Numerous spills have occurred at this site in the past.	II
15	180	Bldg. 883 Drum Storage Area	Three transformers and one switch gear may have leaked oil containing PCBs before being retrofilled in 1987.	II

INDUSTRIAL AREA IM/IRA/DD
PCB SITES

PCB Site	IHSS	LOCATION	DESCRIPTION	CATEGORY
16	Near 179	N of Bldg. 886	Two transformers leaked in the past. The transformers were removed, retrofilled, and moved to another location. The site consists of partial remains of the concrete pads.	II
17	180	Bldg. 883 Drum Storage Area	Transformer 883-4 leaked in the past. The transformer was removed, retrofilled, and moved to another location. The old pad was scarified. The site consists of a partially removed pad.	II
18	178	Bldg. 881 Drum Storage Area	Transformer 881-4 leaked oil containing PCBs before being retrofilled in 1987.	II
19	-	Inside Bldg. 881	Three transformers are separated by enclosed vaults with no drains. A leak was observed above a valve.	II
20	Near 117.1	So of Substation 515-516	Transformer 516. No evidence of leaks. Retrofilled in 1987.	III
21	Near 150.2	Nw corner of Bldg. 776	Transformer is suspected to have leaked. It was removed and the transformer pad has been partially removed.	II
22	Near 150.2 and 162	Sw corner of Bldg. 776	Transformer 370-055 may have leaked from a valve before being retrofilled in 1987.	II
23	Near 150.2, 159, and 162	Adjacent to Bldg. 559	Transformer 559-1 leaked oil containing PCBs from a valve before being retrofilled in 1987 and relocated to another area.	II

INDUSTRIAL AREA IM/IRA/DD
PCB SITES

PCB Site	IHSS	LOCATION	DESCRIPTION	CATEGORY
24	Near 150.5, 147.1, and 121	W of Bldg. 708	Four transformers were moved and retrofilled in 1987. Two of them leaked oil containing PCBs from valves.	II
25	Near 185, 192, and 194	E of Bldg. 707	Documented evidence of a PCB-contaminated oil leak from Transformer 707-1 which is located on the roof of Bldg. 707. Roof and soil adjacent to Bldg. 707 are contaminated.	I
26	150.4 Near 214 and 150.6	N of Bldg. 750	Transformer 750-1 leaked PCBs before being relocated to a new pool several feet east of its original location and retrofilled in 1987.	II
27	-	Inside Bldg. 771	A leak occurred here. The transformer was removed, samples collected, the area decontaminated, and the pad encapsulated.	I
28	-	S of Bldg. 771	Transformer 714-1. No historical evidence of leaks.	III
29	Near 138, 150.8, and 121	N of Bldg. 779	Two transformers (779-1 and 779-2) leaked oil containing PCBs before being retrofilled in 1987 and relocated.	II
30	Adjacent to 173, near 192	E of Bldg. 991	Documented evidence of leaks from Transformer 991-1 and 991-2 before being retrofilled in 1987. Appeared to be leaking in 1991.	II

INDUSTRIAL AREA IM/IRA/DD
PCB SITES

PCB Site	IHSS	LOCATION	DESCRIPTION	CATEGORY
31	Near 150.1, 139.1, 139.2, 163.1, and 163.2	NW of Solar Ponds	Elevated concentrations of PCBs were detected in sediment samples collected in a ditch located about 400 feet NW of the Solar Ponds (Station SED 124).	I
32	Near IHSS 117.1	N of Substation 515-516	No evidence of past or present leaking oil	III
33	Near 151 and 206	N of Bldg. 371	Six transformers may have leaked before being retrofilled in 1987. One transformer was leaking in 1991.	II
34	-	Inside of Bldg. 371	No berm, no sewer drains or lines in vicinity.	III
35	-	E of Bldg. 374	Seventeen 55-gallon drums of PCB-contaminated oil were temporarily stored here in 1980 for EPA. They were removed in 1982.	III
36	-	South of Bldg. 443	PCB contamination found in soils. Soils were remediated in summer of 1993.	-

Category I - Known Releases
Category II - Suspected Releases
Category III - Potential Releases

Information from the *Historical Release Report* (EG&G 1992f) and the *Assessment of Known, Suspect and Potential Environmental Releases of Polychlorinated Biphenyls* (EG&G 1991e)

Note: The PCB site locations are currently being investigated. Some PCB information in the 1992 HRR may be incorrect. The HRR will be updated in March 1994. Sample results from PCB locations are available from EG&G Environmental Management Division.

(intentionally blank)

APPENDIX 3.5
INDUSTRIAL AREA IM/IRA/DD
UNDER-BUILDING CONTAMINATION

(Taken From the Historical Release Report, EG&G 1992f)

(intentionally blank)

3.14 Under Building Contamination

PAC Reference Number: See below

IHSS Reference Number: Not Applicable

Unit Name: Under Building Contamination (UBC)

The following buildings are proposed to be UBCs. The PAC reference number for these sites is UBC with the building number. For example, UBC-122 indicates that Building 122 is considered a Potential Area of Concern due to possible under building contamination.

Building 122 (UBC-122)
Building 123 (UBC-123)
Building 125 (UBC-125)
Building 331 (UBC-331)
Building 371 (UBC-371)
Building 374 (UBC-374)
Building 439 (UBC-439)
Building 440 (UBC-440)
Building 441 (UBC-441)
Building 442 (UBC-442)
Building 444 (UBC-444)
Building 447 (UBC-447)
Building 528 (UBC-528)
Building 559 (UBC-559)
Building 701 (UBC-701)
Building 707 (UBC-707)
Building 731 (UBC-731)
Building 770 (UBC-770)
Building 771 (UBC-771)
Building 774 (UBC-774)
Building 776 (UBC-776)
Building 777 (UBC-777)
Building 778 (UBC-778)
Building 779 (UBC-779)
Building 865 (UBC-865)
Building 881 (UBC-881)
Building 883 (UBC-883)
Building 886 (UBC-886)
Building 887 (UBC-887)
Building 889 (UBC-889)
Building 991 (UBC-991)

Approximate Location: RFP 400-acre manufacturing area (see Figure UBC-1)

Date(s) of Operation or Occurrence

Variable, but the range is from 1952 to present.

Description of Operation or Occurrence

Soil and/or groundwater beneath the identified buildings may have become contaminated because of the nature of the activities within these buildings. Numerous indoor unplanned events and routine operations may have led to under building contamination. These events are not all similar in nature or scope. Some of these unplanned events have involved extremely small spills of hazardous materials (such as that of a reagent bottle in a laboratory) while others have been major industrial accidents (such as the 1969 fire in Building 776 and Building 777). In addition to these identifiable events, there is also the possibility of routine operations contributing to under building contamination. For example, leaking process waste lines could contribute to under building contamination. Leakage from such lines is generally cleaned up upon its identification, but at times the affected environment is under a building and is not remediated. Tanks associated with these buildings may have leaked or may have been overfilled causing a release to the environment. Building sumps, floors, and foundation wall may have cracks or be otherwise unsealed and have created a pathway for contamination of the environment beneath the building.

Some of the events that may have led to under building contamination are listed below. This list is not intended to be complete, it is rather intended to be representative of the types of events that have occurred which may have led to under building contamination.

Building	Description
122	This building houses the Medical Facility. Use of this building began in 1952. This building operated with a 55-gallon drum to receive liquid waste located immediately outside the building. Rusting of this drum and subsequent leakage resulted in some low-level infiltration of the soil under the building and the removal of a section of floor.[1]
123	This building houses the majority of the Health Physics operations. Use of this building began in 1953. Waste chemicals from the laboratory, such as a nitric acid mixed with ether incident in December 1953, were sometimes disposed of out the window during the early years of plant operation.[2] This activity could lead to the presence of nonradioactive pollutants under the building. The Health Physics Laboratory generates low-level radioactive liquid waste and chemical waste. Known or suspected underground waste line leakage has contributed some material to the soil beneath the building.[1]
371	This building houses the new Plutonium Recovery Facility. Use of this building began in 1981.

Maintenance personnel discovered approximately fifty-five gallons of waste water on the floor of Room 2217 on August 2, 1989.[3] This incident resulted in the filing of a RCRA Contingency Plan Implementation Report (89-011).

A RCRA inspection of a 90-day accumulation area located in Room 3811 revealed that a metal 55-gallon drum containing dilute sulfuric acid solution had ruptured on December 20, 1989.[4] This incident resulted in the filing of a RCRA Contingency Plan Implementation Report (89-023).

374 This building houses a process waste treatment system. Limited use of this building began in the late 1970s.

A solution of 40% dissolved nitrate salt overflowed Tank D-883-B in Room 3809 on June 15, 1989, and ran into the process waste floor drains.[5] This incident resulted in the filing of a RCRA Contingency Plan Implementation Report (89-008).

Process solution filled a glove box in Room 3801, pushed out a window of the box, and approximately 50 gallons spilled onto the floor on November 23, 1989.[6] This incident resulted in the filing of a RCRA Contingency Plan Implementation Report (89-021).

Approximately 100 gallons of process waste solution leaked from a pump in Room 3810 and drained through a process floor drain on November 29, 1989.[7] This incident resulted in the filing of a RCRA Contingency Plan Implementation Report (89-022).

Approximately 500 gallons of pH 12.6 solution of hydroxide salt leaked from a tank in Room 4101, some ran through cracks in the concrete floor to a hallway beneath the room.[8] This incident occurred on May 16, 1990, and resulted in the filing of a RCRA Contingency Plan Implementation Report (90-004).

An operator error led to a spill of brine concentrate in Room 3809, the spill was rinsed down the process drains.[9] This incident occurred on September 18, 1990, and resulted in the filing of a RCRA Contingency Plan Implementation Report (90-008).

Due to an inoperative floor drain, 150 gallons of brine concentrate spilled onto the floor of Room 3810.[10] This incident occurred on October 4, 1990, and resulted in the filing of a RCRA Contingency Plan Implementation Report (90-009).

439,440, 444,447 These buildings house modification and machining facilities, which have, in the past, included materials such as uranium, beryllium, and lithium.

A May 1960 vacuum collector fire in Building 447 and a December 1962 uranium/beryllium release from Building 444 have impacted much of the 400 Area. Thus, Building 439, Building 440, Building 444, and Building 447 must be considered radioactively infiltrated to some degree, as should the footings and foundations of these buildings.[1]

442 This building is currently a filter test facility, but once had a decontamination laundry located in it. The first use of this building was in 1953.

The soil beneath the building is potentially affected by both radioactive and chemical materials including uranium, beryllium, and enriched uranium from the laundry operations. The soil in the vicinity of this building has also been affected by instances of radioactive release. In December 1963 rag cleaning barrels leaked or spilled. Liquid drained into the ditch on the northwest side of

the building. In 1964 the laundry was infiltrated by radioactively contaminated clothing fr Building 883.[1]

444 This building houses general fabrication operations. These operations include machining, casting, and other related operations. Use of this building began in 1953.

The sewage treatment plant received a greenish substance which was tracked to Building 444 and an incident involving the overflow of a hazardous waste tank by chromic acid solution on February 22, 1989.[15] This incident resulted in the filing of a RCRA Contingency Plan Implementation Report (89-001).

It was discovered that the continuous flow fabric filter in Room 1 was overflowing. Low-level radioactively contaminated liquid spilled onto the floor in the area of the filter.[12] This incident occurred on July 7, 1989, and resulted in the filing of a RCRA Contingency Plan Implementation Report (89-010).

A 65 gallon spill of process waste water occurred in Room 1 at a temporary bypass for a filter.[13] This incident occurred on September 29, 1989, and resulted in the filing of a RCRA Contingency Plan Implementation Report (89-014).

Approximately 2,000 gallons of process waste water leaked from a fume scrubber tank in Room 204 on October 25, 1989.[14] This incident resulted in the filing of a RCRA Contingency Plan Implementation Report (89-017)

Water used in the suppression of a fire in Room 245 flooded the floor and several baths contain gold cyanide plating solution, sulfuric acid, hydrochloric acid, and nickel. The water then through floor drains and overflowed waste tanks in rooms 9, 10, and 11.[15] This incident occurred on May 21, 1990. A RCRA Contingency Plan Implementation Report (90-005) was filed on this incident.

559 This building houses the plutonium analytical laboratory. Use of this building began in 1968.

The Service Laboratory Facility was originally built with Pyrex glass waste lines in 1968. Less than a year after construction a break was discovered. In 1972, PVC pipe was installed as a replacement. Vertical core sections taken beneath the building confirmed some infiltration.[1]

In May 1977, water in the manhole south of Building 559 was found to contain plutonium contamination.[16]

701 Building 701 is a maintenance shop.

Process waste backed up into a stool and sink.[1]

707 This building houses general fabrication and assembly operations for plutonium. Use of this building began in 1972.

When Building 707 was being built, excavation of the area revealed that the process waste drain from Building 881 had badly corroded with resultant leaks.[17]

731 This building houses process waste tanks for Bulding 707.

On August 28, 1991 the process waste tanks overflowed 750 gallons of process waste to the secondary containment.[18] Although this single event should not have impacted the environment, over the course of operations of Building 707 the possibility exists that the soils near Building 731 have become infiltrated.

770 This building houses waste storage facilities. Use of this building began in 1965.

In August, 1972, a punctured scrap box and drum resulted in up to 200,000 dpm/100 square centimeters and around the building.[1]

771 This building has housed the primary plutonium and americium recovery operations. This building has also had various other operations housed in it. Use of this building began in 1953.

Trichloroethylene was used in October 1957 to clean and prepare concrete floors.[2]

A fire in 1957 resulted in some environmental infiltration along the edges of the building.[1]

A sewer line break in May 1968 at Building 771 resulted in a sewage lift station tank overflow with the release of low level radioactive and chemical materials to the Building 771 outfall.[1]

Construction excavation in September 1971 between Building 771 and Building 774 exposed tunnel which contains a process waste line. The exposed cracks in the tunnel were sealed and eight drums of soil were removed for off-site disposal in January 1972.[1]

During the routine inspection and servicing of Tank #469 in Room 149, plutonium contaminated nitric acid flowed from a port into a pan and onto the floor.[19] This incident occurred April 13, 1989, and resulted in the filing of a RCRA Contingency Plan Implementation Report (89-004).

774 This building houses a liquid process waste treatment system. Use of this building began in 1953.

In October 1956 a process waste tank overflowed. There was some minor environmental infiltration.[1]

In August 1957 leaking process waste tanks resulted in minor environmental infiltration.[1]

In May 1979 the original Building 774 footing drain was located. It had rusted through on the bottom side.[20]

In October 1975, during excavation for a new sump pump (SP-102-2) in Room 102, contaminated soil with over 1.5 M (1,500,000) disintegrations per minute was encountered.[21] A water sample collected on October 30, 1975, from the floor of Room 102 revealed 35,000 counts per minute.[22]

776 This building houses general plutonium fabrication and foundry operations. Use of this building began in 1957.

A fire on May 11, 1969 released plutonium to all of Building 776 and Building 777 and areas of Building 771, Building 778, and Building 779.[1]

In June 1964 a glove box explosion resulted in an extensive release of plutonium to the interior and exterior of the building.[1]

In October 1964 a tagged out valve was opened allowing contaminated carbon tetrachloride to overflow a lathe box and flow through a crack in the floor, contaminating the room below.[2]

On October 23, 1989, personnel in the Non-Destructive Analyses group noticed a liquid from the process waste tanks T-1A&B and T-2A&B on the floor and in the bermed area.[23] This incident resulted in the filing of a RCRA Contingency Plan Implementation Report (89-016).

779 This building houses general plutonium research and development activities. Use of this building began in 1965.

Building 779 was erected over the site of one of the original solar evaporation ponds. During excavation in September 1962, radioactive readings from 11-75 dpm/l were noted, and later, pools of water in these excavations reached levels of 150 dpm/l. The radioactive material involved was mostly uranium.[1]

In June 1969 an improperly opened waste drum resulted in the spread of radioactive material throughout the building and adjacent grounds.[1]

881 Building 881 currently houses primarily laboratory and office support operations. Various other operations have been conducted in this building such as uranium recovery, machining, and fabrication. Use of this building began in 1953.

Waste lines have been broken with probable infiltration of the soil.[1]

883 This building houses general rolling, forming, and forging operations. Use of this building began in 1957.

On October 27, 1989, process waste water was noted to be overflowing from a tank in Room 139, some of the water flowed under the wall.[24] This incident resulted in the filing of a RCRA Contingency Plan Implementation Report (89-018).

887 This building houses process waste and sanitary waste holding tanks. Use of this building began in 1953.

On September 21, 1989, a utility worker discovered that the process waste tanks had over-flowed on to the floor with excess water from the acid scrubbers in room 266.[25] This incident resulted in the filing of a RCRA Contingency Plan Implementation Report (89-013)

991 This building currently houses storage, non-destructive testing, and metallography operations. Various other operations have been conducted in this building in the past such as assembly of some parts, laboratory work, and shipping and receiving. (Although identified as UBC-991, this UBC is also considered to include the associated storage vaults - Building 996, Building 997, Building 998, and Building 999 - and is identified as such on the map).

It was stated that trace uranium and plutonium infiltration of soils under Building 991 was possible, although concentrations of uranium might be undetectable.[1] Also, according to CEARP Phase 1, routine surveys of the vaults associated with Building 991 have indicated that they are free of radioactive contamination, with the exception of tunnel 996 which might be slightly uranium infiltrated.[26]

In addition to the information available on specific events in or near buildings that may have led to under building contamination, there are also data that indicate the presence of contamination under buildings. These data were generated as a part of routine environmental monitoring, or generated in response to some specific activity or event. Footing drain and building sump data provide indications of possible under building contamination when some analytical parameters in the water from the footing or building sump are present in elevated concentrations. The water from footing drain and building sumps has historically been analyzed for total dissolved solids, conductivity, nitrate nitrogen, pH, gross alpha activity, gross beta activity, and tritium activity. Footing drains and building sumps for which elevated concentrations of some contaminant or indicator parameter have been noted at least once include: the number one Footing Drain (FD) for Building 371 (FD 371-1), FD 371-2, Building Sump (BS) 444-2, FD 516-1, FD 707-1, BS 707-2, BS 707-3, FD 771-1, FD 774-1, FD 779-1, and BS 887-1.[27,28] More recent analyses indicate that solvents are present in some footing drains and may be present in other footing drains.[29]

Additionally, pipes and other materials may remain with contamination present in them even though the use of the building has changed and that particular pipe may no longer be in use. For instance, Building 331 once handled uranium, and as late as 1977 uranium contamination was found in the building.[30,31]

Physical/Chemical Description of Constituents Released:

These soils may be contaminated with radionuclides, nitrate, solvents, acids, and bases. The most likely contaminants in soils beneath any particular building can be identified through knowledge of the operations conducted in that building and the raw and waste materials associated with those operations. The contaminants suspected under a building should be based on the overall history of the building, not just the current operations. For instance, Building 331 is currently a vehicle maintenance and repair garage and may therefore be expected to have solvents and oil present in soils beneath the building. However, in the past portions of the building were used for uranium operations so that uranium contaminated soils may also be present under the building.[30,31]

Responses to Operation or Occurrence:

A number of RCRA Contingency Plan Implementation Reports have been made in response to inside building events that could contribute to under building contamination. These RCRA Contingency Plan Implementation Reports are numbered in a manner that gives the year and a sequential number for the RCRA Contingency Plan Implementation Reports of that year. The RCRA Contingency Plan Implementation Reports addressing indoor building events are: 89-001, 89-004, 89-008, 89-010, 89-011, 89-013, 89-014, 89-016, 89-017, 89-018, 89-021, 89-022, 89-023, 90-004, 90-005, 90-008, 90-009, and 91-016.

Inside building events have largely been cleaned-up or otherwise addressed without noticeable impacts on the outdoor environment. However, due to the long time frame, history of operations, and difficulty in detecting soil contamination beneath buildings, the soils beneath a number of buildings should clearly be considered PACs.

Fate of Constituents Released to Environment:

No documentation was found detailing the fate of constituents released to the environment.

Comments:

For the purposes of this document the buildings listed under Unit Name have been added to the list of PACs. Some are already addressed as separate PACs. Further information on the drains and underground waste lines can be found in Water Quality Data For Foundations And Building Sumps (Document #1600830).

References:

[1] 1601057
[2] 1600065
[3] 1700784
[4] 1700796
[5] 1700781
[6] 1700794
[7] 1700795
[8] 1700799
[9] 1700803
[10] 1700804
[11] 1800023
[12] 1700783
[13] 1700787
[14] 1700790
[15] 1700800
[16] 1500863
[17] 1600169
[18] 1503414
[19] 1800028
[20] 1500925
[21] 1700452
[22] 1600187
[23] 1700789
[24] 1700791
[25] 1700786
[26] 1501999
[27] 1600830
[28] 1500883
[29] 1503441
[30] 1500584
[31] 1500979

Other References of Interest

1600059

APPENDIX 3.6
INDUSTRIAL AREA IM/IRA/DD
CHEMICAL INVENTORY

(intentionally blank)

Appendix 3.6

Table A
Industrial Area IM/IRA/DD
List of Chemicals Excluded from the Chemicals of Interest

(These chemicals were excluded because they totaled less than 100 pounds at any particular location.)

Air
Argon
Nitrogen
Liquid Nitrogen
Propane
Treated Water
Influent Water
Domestic Water
Domestic Cold Water
Hydrogen Peroxide
Antifreeze/Coolant
ATF, Mercon/Dexron II
Corrosion Inhibitor
DDO #19
Disc Brake Squeal Silencer
Dixchlor Sodium Hypochlorite
Foamtrol
Elastic Polyether Impression Material
Envirostone Emulsifier
Ethylene Glycol
Fluid, #200
Fluid, #550
Mariko
Lubricant, Way 68
Microsol E-1008 Blue
Oil, Alcaid #60
Oil, Spindura
Oil, Vactra
Polymer, 1192
Process Waste
Propylene Glycol
Raw Sewage
All Regal Oil R&D 68
All Regal Oil R&O 68
Sodium Hydroxide
Sunquench 1021
Tranutex F
Trim Sol
Unisyn #6085 and 6085A
Uncontaminated Wastewater
Velocite Oil

Appendix 3.6
Table B
Industrial Area IM/IRA/DD
Chemicals of Interest

BUILDING	CHEMICAL NAME	QUANTITY	STORAGE
123	Dibutyldiethylcarbaramoylphosphonate	1,000 gal.	
123	Methylene chloride	500 gal.	
124	Fuel Oil #2	50 gal.	AST
125	Mercury	215 lb.	Glass Jugs
130	Nitric Acid	714 lb.	
130	Nitric Acid	1,125 lb.	Glass
130	Phosphoric Acid	440 gal.	
218	Nitric Acid	20,000 gal.	AGT
218	Nitric Acid	20,000 gal.	
221W	Fuel Oil #6	783,958 gal.	
224	Fuel Oil #6	1,900,000 gal.	AST
224	Fuel Oil #6	1,890,000 gal.	AST
331	Diesel Blend #2 60% 1# 40%	6,000 gal.	UST
331	Gasoline	24,800 gal.	UST
371	Solvent Mineral Spirits	55 gal.	
372A	Diesel Fuel	138 gal.	
374	Phosphoric Acid 85%	396 gal.	
374	Sulfamic Acid	200 lb.	
374	Hydrochloric Acid	100 gal.	
374	Nitric Acid	31,432 gal.	
374	Sodium Hydroxide	13,813 gal.	STL Drum
444	1,1,1-Trichloroethane	120 lb.	Fiber Drum
444	Oakite 162	500 lb.	Fiber Drum
444	Oakite Concentrate	190 lb.	Fiber Drum
444	Oakite 160	500 lb.	AST
549	Freon 12	24 gal.	
551	Oakite Aluminum Cleaner NST	360 gal.	ST Drum
551	1,1,2-Trichlorotrifluoroethane	4,140 lb.	

Appendix 3.6
Table B
Industrial Area IM/IRA/DD
Chemicals of Interest

BUILDING	CHEMICAL NAME	QUANTITY	STORAGE
559	Diesel Fuel	1,000 gal.	UST
562	Diesel Fuel	3,000 gal.	UST
61	Tremlastic	400 gal.	
707	Carbon Tetrachloride	10,440 gal.	AST
709	Diesel Fuel	8,400 gal.	UST
709	Diesel Blend	4,000 gal.	UST
715	Diesel Fuel	5,260 gal.	UST
727	Diesel Fuel	3,000 gal.	UST
771	Nitric Acid 12N	600 gal.	UST
771	Nitric Acid .35N	210 gal.	UST
771	Potassium Hydroxide	5,500 gal	AST
771	Sulfuric Acid	440 lb.	Containers
771	Lewatit MP, #500	1,770 lb.	Fiber Drum
771	Lewatit Ump, #950	1,202 lb.	Fiber Drum
771	Nitric Acid 7N	210 gal.	UST
771	Fuel Oil	5,600 gal.	AST
776	Trichlorotrifluoromethane	1,380 lb.	Steel Drum
776	Diesel Fuel	5,000 gal.	UST
779	Diesel Fuel	560 gal.	AST
881	Diesel Fuel	5,000 gal.	UST
891	Hydrochloric Acid	2,159 gal.	UST
891	Sodium Hydroxide	1,144 gal.	AST
989	Diesel Fuel	3,000 gal.	UST
T221W	Fuel Oil #6	783,958 gal.	AST
707	Solvent III	5,400 lb.	
551	Freon 11	270 gal.	
551	1,1,2-Trichloro-1,2,2-Trifluoroethane	1,380 lb.	
663	Cleaner, Freon TF	110 gal.	
707	Trichloroethane	600 gal.	
883	Perchloroethylene	732 gal.	

(intentionally blank)

APPENDIX 3.7

INDUSTRIAL AREA IM/IRA/DD

PERMITTED STORAGE UNITS

(intentionally blank)

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D001		RES,REM	371	90.2	3606	PSA	A
D002		RES,REM	371	90.2	3606	PSA	A
D003		RES,REM	371	90.2	3606	PSA	A
D004		RES,REM	371	90.2	3606	PSA	A
D005		RES,REM	371	90.2	3606	PSA	A
D006		RES,REM	371	90.2	3606	PSA	A
D007		RES,REM	371	90.2	3606	PSA	A
D008	LEAD	RES,REM	371	90.2	3606	PSA	A
D009	MERCURY	RES,REM	371	90.2	3606	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D010	SELENIUM	RES,REM	371	90.2	3606	PSA	A
D011	SILVER	RES,REM	371	90.2	3606	PSA	A
D019	CARBON TET	RES,REM	371	90.2	3606	PSA	A
ENDRIN		RES,REM	371	90.2	3606	PSA	A
ENDRIN		RES,REM	371	90.2	3606	PSA	A
ENDRIN		RES,REM	371	90.2	3606	PSA	A
ENDRIN		RES,REM	371	90.2	3606	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.20	2223	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.3	3337	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.4	3543	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
ENDRIN		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,STD,TRM,LLM	371	90.11	3187B	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D001		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D002		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D003		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D004		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D005		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D006		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D007		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D008	LEAD	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D009	MERCURY	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D010	SELENIUM	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D011	SILVER	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D018	BENZENE	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D019	CARBON TET	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D022	CHLOROFORM	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D028	1,4-DICHLOROETHANE	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D029	1,1-DICHLOROETHENE	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,STD,TRM,LLM	371	90.11	3187B	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.5	2207	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.6	3321	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.62	3501	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,STD,TRM,LLM	371	90.11	3187B	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,STD,TRM,LLM	371	90.11	3187B	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,STD,TRM,LLM	371	90.11	3187B	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,STD,TRM,LLM	371	90.11	3187B	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,STD,TRM,LLM	371	90.11	3187B	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,STD,TRM,LLM	371	90.11	3187B	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.13	3515	PSA	A
D001		LLW,HAZ,LLM	371	90.142	3408	PSA	A
D002		LLW,HAZ,LLM	371	90.142	3408	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D003		LLW,HAZ,LLM	371	90.142	3408	PSA	A
D004		LLW,HAZ,LLM	371	90.142	3408	PSA	A
D005		LLW,HAZ,LLM	371	90.142	3408	PSA	A
D006		LLW,HAZ,LLM	371	90.142	3408	PSA	A
D007		LLW,HAZ,LLM	371	90.142	3408	PSA	A
D008	LEAD	LLW,HAZ,LLM	371	90.142	3408	PSA	A
D009	MERCURY	LLW,HAZ,LLM	371	90.142	3408	PSA	A
D010	SELENIUM	LLW,HAZ,LLM	371	90.142	3408	PSA	A
D011	SILVER	LLW,HAZ,LLM	371	90.142	3408	PSA	A
D018	BENZENE	LLW,HAZ,LLM	371	90.142	3408	PSA	A
D019	CARBON TET	LLW,HAZ,LLM	371	90.142	3408	PSA	A
D035	MEK	LLW,HAZ,LLM	371	90.142	3408	PSA	A
D041	2,4,5-TRICHLOROPHENOL	LLW,HAZ,LLM	371	90.142	3408	PSA	A
ENDRIN		LLW,HAZ,LLM	371	90.142	3408	PSA	A
ENDRIN		LLW,HAZ,LLM	371	90.142	3408	PSA	A
ENDRIN		LLW,HAZ,LLM	371	90.142	3408	PSA	A
ENDRIN		LLW,HAZ,LLM	371	90.142	3408	PSA	A
ENDRIN		LLW,HAZ,LLM	371	90.142	3408	PSA	A
ENDRIN		LLW,HAZ,LLM	371	90.142	3408	PSA	A
ENDRIN		LLW,HAZ,LLM	371	90.142	3408	PSA	A
D001		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D002		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D003		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D004		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D005		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D006		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D007		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D018	BENZENE	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D022	CHLOROFORM	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D028	1,4-DICHLOROETHANE	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D029	1,1-DICHLOROETHENE	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D035	MEK	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D038	PYRIDINE	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D040	TRICHLOROETHYLENE	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D043	VINYL CHLORIDE	RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TRM,EMT	371	90.10	2202A_B_C	PSA	A
D001		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.16	2325	PSA	A
D004		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D002		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D002		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.16	2325	PSA	A
D003		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.16	2325	PSA	A
D004		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.16	2325	PSA	A
D005		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.16	2325	PSA	A
D006		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.16	2325	PSA	A
D007		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.16	2325	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.16	2325	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.16	2325	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.16	2325	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
		M					
D011	SILVER	RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
D018	BENZENE	RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
D022	CHLOROFORM	RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
D028	1,4-DICHLOROETHANE	RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
D029	1,1-DICHLOROETHENE	RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
D035	MEK	RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
D038	PYRIDINE	RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
D040	TRICHLOROETHYLENE	RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
D043	VINYL CHLORIDE	RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL M	371	90.16	2325	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.16	2325	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.16	2325	PSA	A
		M					
D001		RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D002		RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D003		RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D004		RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D005		RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D006		RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D007		RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D008	LEAD	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D009	MERCURY	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D010	SELENIUM	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D011	SILVER	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D018	BENZENE	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D019	CARBON TET	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D022	CHLOROFORM	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D028	1,4-DICHLOROETHANE	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D029	1,1-DICHLOROETHENE	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D035	MEK	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D038	PYRIDINE	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
		M					
D040	TRICHLOROETHYLENE	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
D043	VINYL CHLORIDE	RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
ENDRIN		RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
ENDRIN		RES,LAB,TRU,LLW,REM,STD,TRM,LL	371	90.11	3187B	PSA	A
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.63	1210	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D001		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D002		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D003		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D004		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D005		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D006		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D007		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D008	LEAD	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
		M					
D009	MERCURY	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D010	SELENIUM	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D011	SILVER	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D018	BENZENE	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D019	CARBON TET	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D022	CHLOROFORM	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D028	1,4-DICHLOROETHANE	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D029	1,1-DICHLOROETHENE	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D035	MEK	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D038	PYRIDINE	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D040	TRICHLOROETHYLENE	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D043	VINYL CHLORIDE	RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LL	371	90.70	3602	PSA	A
		M					
D001		RES,REM,LAB	371	90.71	3511	PSA	A
D002		RES,REM,LAB	371	90.71	3511	PSA	A
D003		RES,REM,LAB	371	90.71	3511	PSA	A
D004		RES,REM,LAB	371	90.71	3511	PSA	A
D005		RES,REM,LAB	371	90.71	3511	PSA	A
D006		RES,REM,LAB	371	90.71	3511	PSA	A
D007		RES,REM,LAB	371	90.71	3511	PSA	A
D008	LEAD	RES,REM,LAB	371	90.71	3511	PSA	A
D009	MERCURY	RES,REM,LAB	371	90.71	3511	PSA	A
D010	SELENIUM	RES,REM,LAB	371	90.71	3511	PSA	A
D011	SILVER	RES,REM,LAB	371	90.71	3511	PSA	A
D019	CARBON TET	RES,REM,LAB	371	90.71	3511	PSA	A
ENDRIN		RES,REM,LAB	371	90.71	3511	PSA	A
ENDRIN		RES,REM,LAB	371	90.71	3511	PSA	A
ENDRIN		RES,REM,LAB	371	90.71	3511	PSA	A
ENDRIN		RES,REM,LAB	371	90.71	3511	PSA	A
D001		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D002		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D003		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D004		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D005		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D006		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D007		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		RES,REM,TRU,LLW,LAB,STD,NON	371	90.72	3202	PSA	A
D001		RES,REM,LAB	371	90.73	3303	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.7	3341	PSA	A
D029	1,1-DICHLOROETHENE	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
ENDRIN		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D001		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D002		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D002		RES,REM,LAB	371	90.73	3303	PSA	A
D003		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D004		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D005		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D006		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D007		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D018	BENZENE	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D022	CHLOROFORM	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D028	1,4-DICHLOROETHANE	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D029	1,1-DICHLOROETHENE	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D035	MEK	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D038	PYRIDINE	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D040	TRICHLOROETHYLENE	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D043	VINYL CHLORIDE	RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D003		RES,REM,LAB	371	90.73	3303	PSA	A
D004		RES,REM,LAB	371	90.73	3303	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D005		RES,REM,LAB	371	90.73	3303	PSA	A
D006		RES,REM,LAB	371	90.73	3303	PSA	A
D007		RES,REM,LAB	371	90.73	3303	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D008	LEAD	RES,REM,LAB	371	90.73	3303	PSA	A
D001		RES,REM	371	90.100	STACKER	PSA	A
D002		RES,REM	371	90.100	STACKER	PSA	A
D003		RES,REM	371	90.100	STACKER	PSA	A
D004		RES,REM	371	90.100	STACKER	PSA	A
D005		RES,REM	371	90.100	STACKER	PSA	A
D006		RES,REM	371	90.100	STACKER	PSA	A
D007		RES,REM	371	90.100	STACKER	PSA	A
D008	LEAD	RES,REM	371	90.100	STACKER	PSA	A
D009	MERCURY	RES,REM	371	90.100	STACKER	PSA	A
D010	SELENIUM	RES,REM	371	90.100	STACKER	PSA	A
D011	SILVER	RES,REM	371	90.100	STACKER	PSA	A
D019	CARBON TET	RES,REM	371	90.100	STACKER	PSA	A
ENDRIN		RES,REM	371	90.100	STACKER	PSA	A
ENDRIN		RES,REM	371	90.100	STACKER	PSA	A
ENDRIN		RES,REM	371	90.100	STACKER	PSA	A
ENDRIN		RES,REM	371	90.100	STACKER	PSA	A
D001		REM	371	90.104	3305	PSA	A
D002		REM	371	90.104	3305	PSA	A
D003		REM	371	90.104	3305	PSA	A
D004		REM	371	90.104	3305	PSA	A
D005		REM	371	90.104	3305	PSA	A
D006		REM	371	90.104	3305	PSA	A
D007		REM	371	90.104	3305	PSA	A
D008	LEAD	REM	371	90.104	3305	PSA	A
D009	MERCURY	REM	371	90.104	3305	PSA	A
D010	SELENIUM	REM	371	90.104	3305	PSA	A
D011	SILVER	REM	371	90.104	3305	PSA	A
D019	CARBON TET	REM	371	90.104	3305	PSA	A
ENDRIN		REM	371	90.104	3305	PSA	A
ENDRIN		REM	371	90.104	3305	PSA	A
ENDRIN		REM	371	90.104	3305	PSA	A
ENDRIN		REM	371	90.104	3305	PSA	A
D001		REM	371	90.104	GB-37C	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D002		REM	371	90.104	GB-37C	PSA	A
D003		REM	371	90.104	GB-37C	PSA	A
D004		REM	371	90.104	GB-37C	PSA	A
D005		REM	371	90.104	GB-37C	PSA	A
D006		REM	371	90.104	GB-37C	PSA	A
D007		REM	371	90.104	GB-37C	PSA	A
D008	LEAD	REM	371	90.104	GB-37C	PSA	A
D009	MERCURY	REM	371	90.104	GB-37C	PSA	A
D010	SELENIUM	REM	371	90.104	GB-37C	PSA	A
D002		RES,REM,TRU,LLW,LAB,SID,LLM,TRM	371	90.9	3206	PSA	A
D011	SILVER	REM	371	90.104	GB-37C	PSA	A
D019	CARBON TET	REM	371	90.104	GB-37C	PSA	A
ENDRIN		REM	371	90.104	GB-37C	PSA	A
ENDRIN		REM	371	90.104	GB-37C	PSA	A
ENDRIN		REM	371	90.104	GB-37C	PSA	A
ENDRIN		REM	371	90.104	GB-37C	PSA	A
D009	MERCURY	RES,REM,LAB	371	90.73	3303	PSA	A
D010	SELENIUM	RES,REM,LAB	371	90.73	3303	PSA	A
D011	SILVER	RES,REM,LAB	371	90.73	3303	PSA	A
D019	CARBON TET	RES,REM,LAB	371	90.73	3303	PSA	A
ENDRIN		RES,REM,LAB	371	90.73	3303	PSA	A
ENDRIN		RES,REM,LAB	371	90.73	3303	PSA	A
ENDRIN		RES,REM,LAB	371	90.73	3303	PSA	A
ENDRIN		RES,REM,LAB	371	90.73	3303	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
ENDRIN		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
ENDRIN		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
ENDRIN		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
ENDRIN		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
ENDRIN		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
ENDRIN		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
ENDRIN		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D043	VINYL CHLORIDE	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D040	TRICHLOROETHYLENE	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D038	PYRIDINE	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D035	MEK	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D001		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D028	1,4-DICHLOROETHANE	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D019	CARBON TET	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D018	BENZENE	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D011	SILVER	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D010	SELENIUM	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D009	MERCURY	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D008	LEAD	TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D007		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D006		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
D005		TRM,LAB,TRU,STD,REM,RES,LLM,LLW	371	63	3420	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.8	3567A	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D001		RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D035	MEK	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D018	BENZENE	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D022	CHLOROFORM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D028	1,4-DICHLOROETHANE	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D029	1,1-DICHLOROETHENE	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D035	MEK	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D038	PYRIDINE	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D040	TRICHLOROETHYLENE	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D043	VINYL CHLORIDE	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D038	PYRIDINE	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D040	TRICHLOROETHYLENE	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
D043	VINYL CHLORIDE	LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		LAB,LLW,LLM,REM,RES,STD,TRM,TRU,LLT	371	90.1	3189	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.96	3204	PSA	A
D003		RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D004		RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D005		RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D006		RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D007		RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D018	BENZENE	RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D022	CHLOROFORM	RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D028	1,4-DICHLOROETHANE	RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D029	1,1-DICHLOROETHENE	RES,REM,TRU,LLW,LAB,STD,LLM,TRM	371	90.9	3206	PSA	A
D035	MEK	RES,REM,TRU,LLW,LAB,STD,LLM,TR	371	90.9	3206	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
		M					
D038	PYRIDINE	RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
D040	TRICHLOROETHYLENE	RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
D043	VINYL CHLORIDE	RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,LLM,TR M	371	90.9	3206	PSA	A
D001		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D002		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D003		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D004		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D005		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D006		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D001		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D002		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D003		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D004		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D005		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D006		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D007		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D008	LEAD	RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D009	MERCURY	RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D010	SELENIUM	RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D011	SILVER	RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D019	CARBON TET	RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
ENDRIN		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
ENDRIN		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
ENDRIN		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
ENDRIN		RES,LAB,TRU,LLW	371	90.12	1101	PSA	A
D007		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D001		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D002		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D003		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D004		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D005		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D006		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D007		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD,TRM,LLM	371	90.14	1111	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.94	3331	PSA	A
D001		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D002		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D003		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D004		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D005		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D006		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D007		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,STD	371	90.95	3327	PSA	A
D001		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
D002		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
D003		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
D004		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
D005		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
D006		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
D007		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
D008	LEAD	RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
D009	MERCURY	RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D010	SELENIUM	RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
D011	SILVER	RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
D019	CARBON TET	RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
ENDRIN		RES,LAB,TRU,LLW,REM,TRM,LLM	371	90.15	1208	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.18	3412	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D004		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	371	90.19	1115	PSA	A
D007		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
D004		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
D002		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
D001		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
		LLW,LLM,LAB	374	42.28	3809	PTA	A
		LLW,LLM,LAB	374	42.78	3803	PTA	A
D005		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
ENDRIN		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
ENDRIN		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
ENDRIN		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
D006		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
ENDRIN		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
ENDRIN		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
ENDRIN		HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
D011	SILVER	HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
D010	SELENIUM	HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
D009	MERCURY	HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
D008	LEAD	HAZ,LLW,LLM,TRU,TRM,EMT	374	42.77	2804	PTA	A
D010	SELENIUM	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D005		LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D002		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D029	1,1-DICHLOROETHENE	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D035	MEK	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D038	PYRIDINE	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D040	TRICHLOROETHYLENE	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D043	VINYL CHLORIDE	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
ENDRIN		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
ENDRIN		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
ENDRIN		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
ENDRIN		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D028	1,4-DICHLOROETHANE	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D001		LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D002		LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D004		LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D019	CARBON TET	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D006		LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D007		LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D008	LEAD	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D009	MERCURY	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D001		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D010	SELENIUM	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
ENDRIN		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D043	VINYL CHLORIDE	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D040	TRICHLOROETHYLENE	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D038	PYRIDINE	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D035	MEK	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D029	1,1-DICHLOROETHENE	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D028	1,4-DICHLOROETHANE	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D019	CARBON TET	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D018	BENZENE	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D011	SILVER	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
ENDRIN		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D009	MERCURY	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D008	LEAD	LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D007		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D006		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D005		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D004		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D002		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
ENDRIN		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
ENDRIN		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
ENDRIN		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
ENDRIN		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
ENDRIN		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
ENDRIN		LLW,TRU,LLM,TRM,NON,LAB	374	19	3813	PSA	A
D001		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D011	SILVER	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D018	BENZENE	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D019	CARBON TET	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D028	1,4-DICHLOROETHANE	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D029	1,1-DICHLOROETHENE	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D035	MEK	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D038	PYRIDINE	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D040	TRICHLOROETHYLENE	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D043	VINYL CHLORIDE	LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
ENDRIN		LLM,HAZ,LLW	374	43.01	SE_OF_374-T231A	PST	A
D018	BENZENE	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
ENDRIN		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
ENDRIN		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
ENDRIN		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D004		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D005		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D006		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D007		LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D008	LEAD	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D009	MERCURY	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D010	SELENIUM	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D011	SILVER	LLM,HAZ,LLW	374	43.02	SE_3717-T231B	PST	A
D043	VINYL CHLORIDE	LLM,HAZ,LLW	444	39.01	10	PST	A
ENDRIN		LLM,HAZ,LLW	444	39.01	10	PST	A
ENDRIN		LLM,HAZ,LLW	444	39.01	10	PST	A
ENDRIN		LLM,HAZ,LLW	444	39.01	10	PST	A
ENDRIN		LLM,HAZ,LLW	444	39.01	10	PST	A
D001		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D029	1,1-DICHLOROETHENE	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D038	PYRIDINE	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D040	TRICHLOROETHYLENE	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D043	VINYL CHLORIDE	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D019	CARBON TET	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D006		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D007		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D008	LEAD	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D009	MERCURY	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D010	SELENIUM	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D011	SILVER	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D018	BENZENE	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D008	LEAD	LLM,HAZ,LLW	444	39.01	10	PST	A
D040	TRICHLOROETHYLENE	LLM,HAZ,LLW	444	39.01	10	PST	A
D028	1,4-DICHLOROETHANE	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D004		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
ENDRIN		LLM,HAZ,LLW	444	39.01	10	PST	A
D035	MEK	TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
		LLW,LAB,LLT,NON	444	0	116	NRA	A
		LAB,LLM	444	39.01	1	PTA	A
ENDRIN		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D002		LLM,HAZ,LLW	444	39.01	10	PST	A
ENDRIN		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
ENDRIN		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
ENDRIN		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
ENDRIN		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
ENDRIN		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
ENDRIN		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D029	1,1-DICHLOROETHENE	LLM,HAZ,LLW	444	39.01	10	PST	A
D001		LLM,HAZ,LLW	444	39.01	10	PST	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D038	PYRIDINE	LLM,HAZ,LLW	444	39.01	10	PST	A
D004		LLM,HAZ,LLW	444	39.01	10	PST	A
D005		LLM,HAZ,LLW	444	39.01	10	PST	A
D007		LLM,HAZ,LLW	444	39.01	10	PST	A
D005		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D018	BENZENE	LLM,HAZ,LLW	444	39.01	10	PST	A
D019	CARBON TET	LLM,HAZ,LLW	444	39.01	10	PST	A
D028	1,4-DICHLOROETHANE	LLM,HAZ,LLW	444	39.01	10	PST	A
D002		TRU,LLM,HAZ,TRM,LLW	444	40.06	CN_T-3	PST	A
D035	MEK	LLM,HAZ,LLW	444	39.01	10	PST	A
ENDRIN		LLM,LLW	447	30	510	PSA	A
D038	PYRIDINE	LLM,LLW	447	30	510	PSA	A
ENDRIN		LLM,LAB	447	6	501	PSA	A
D002		LLM,HAZ,LLW	447	39.02	NA	PTA	A
D004		LLM,HAZ,LLW	447	39.02	NA	PTA	A
D019	CARBON TET	LLM,LLW	447	30	510	PSA	A
D028	1,4-DICHLOROETHANE	LLM,LLW	447	30	510	PSA	A
D029	1,1-DICHLOROETHENE	LLM,LLW	447	30	510	PSA	A
D035	MEK	LLM,LLW	447	30	510	PSA	A
D040	TRICHLOROETHYLENE	LLM,LLW	447	30	510	PSA	A
D043	VINYL CHLORIDE	LLM,LLW	447	30	510	PSA	A
ENDRIN		LLM,LLW	447	30	510	PSA	A
ENDRIN		LLM,LAB	447	6	501	PSA	A
ENDRIN		LLM,LLW	447	30	510	PSA	A
ENDRIN		LLM,HAZ,LLW	447	39.02	NA	PTA	A
ENDRIN		LLM,HAZ,LLW	447	39.02	NA	PTA	A
D008	LEAD	LLM,HAZ,LLW	447	39.02	NA	PTA	A
D019	CARBON TET	LLM,HAZ,LLW	447	39.02	NA	PTA	A
D028	1,4-DICHLOROETHANE	LLM,HAZ,LLW	447	39.02	NA	PTA	A
ENDRIN		LLM,LAB	447	6	501	PSA	A
D029	1,1-DICHLOROETHENE	LLM,HAZ,LLW	447	39.02	NA	PTA	A
D035	MEK	LLM,HAZ,LLW	447	39.02	NA	PTA	A
D038	PYRIDINE	LLM,HAZ,LLW	447	39.02	NA	PTA	A
D018	BENZENE	LLM,LAB	447	6	501	PSA	A
D018	BENZENE	LLM,LLW	447	30	510	PSA	A
ENDRIN		LLM,HAZ,LLW	447	39.02	NA	PTA	A
ENDRIN		LLM	447	30	501	PTA	A
D005		LLM,HAZ,LLW	447	39.02	NA	PTA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D018	BENZENE	LLM,HAZ,LLW	447	39.02	NA	PTA	A
		LAB,LLM	447	39.02	31	PTA	A
D040	TRICHLOROETHYLENE	LLM,HAZ,LLW	447	39.02	NA	PTA	A
D043	VINYL CHLORIDE	LLM,HAZ,LLW	447	39.02	NA	PTA	A
ENDRIN		LLM,HAZ,LLW	447	39.02	NA	PTA	A
D007		LLM,HAZ,LLW	447	39.02	NA	PTA	A
D043	VINYL CHLORIDE	LLM,LAB	447	6	501	PSA	A
ENDRIN		LLM,HAZ,LLW	447	39.02	NA	PTA	A
ENDRIN		LLM	447	30	501	PTA	A
D001		LLM,LAB	447	6	501	PSA	A
D001		LLM,HAZ,LLW	447	39.02	NA	PTA	A
D001		LLM,LLW	447	30	510	PSA	A
D019	CARBON TET	LLM,LAB	447	6	501	PSA	A
D028	1,4-DICHLOROETHANE	LLM,LAB	447	6	501	PSA	A
D029	1,1-DICHLOROETHENE	LLM,LAB	447	6	501	PSA	A
D035	MEK	LLM,LAB	447	6	501	PSA	A
D038	PYRIDINE	LLM,LAB	447	6	501	PSA	A
D040	TRICHLOROETHYLENE	LLM,LAB	447	6	501	PSA	A
		LAB,HAZ,LLW	460	39.03	140	PTA	A
D004		LLM,HAZ,LLW	551	18.01	NA	PST	A
D006		LLM,HAZ,LLW	551	18.05	NA	PST	A
D005		LLM,HAZ,LLW	551	18.05	NA	PST	A
D004		LLM,HAZ,LLW	551	18.05	NA	PST	A
D008	LEAD	LLM,HAZ,LLW	551	18.06	NA	PST	A
D022	CHLOROFORM	LLM,HAZ,LLW	551	18.05	NA	PST	A
D008	LEAD	LLM,HAZ,LLW	551	18.01	NA	PST	A
D007		LLM,HAZ,LLW	551	18.01	NA	PST	A
D007		LLM,HAZ,LLW	551	18.05	NA	PST	A
ENDRIN		LLM,HAZ,LLW	551	18.05	NA	PST	A
D008	LEAD	LLM,HAZ,LLW	551	18.05	NA	PST	A
D005		LLM,HAZ,LLW	551	18.01	NA	PST	A
ENDRIN		LLM,HAZ,LLW	551	18.06	NA	PST	A
ENDRIN		LLM,HAZ,LLW	551	18.05	NA	PST	A
D019	CARBON TET	LLM,HAZ,LLW	551	18.05	NA	PST	A
D011	SILVER	LLM,HAZ,LLW	551	18.05	NA	PST	A
D009	MERCURY	LLM,HAZ,LLW	551	18.05	NA	PST	A
ENDRIN		LLM,HAZ,LLW	551	18.01	NA	PST	A
ENDRIN		LLM,HAZ,LLW	551	18.01	NA	PST	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		LLM,HAZ,LLW	551	18.01	NA	PST	A
D009	MERCURY	LLM,HAZ,LLW	551	18.06	NA	PST	A
D019	CARBON TET	LLM,HAZ,LLW	551	18.01	NA	PST	A
D011	SILVER	LLM,HAZ,LLW	551	18.01	NA	PST	A
D009	MERCURY	LLM,HAZ,LLW	551	18.01	NA	PST	A
D019	CARBON TET	LLM,HAZ,LLW	551	18.02	NA	PTA	A
D004		LLM,HAZ,LLW	551	18.02	NA	PTA	A
ENDRIN		LLM,HAZ,LLW	551	18.06	NA	PST	A
ENDRIN		LLM,HAZ,LLW	551	18.02	NA	PTA	A
D022	CHLOROFORM	LLM,HAZ,LLW	551	18.01	NA	PST	A
D005		LLM,HAZ,LLW	551	18.02	NA	PTA	A
D006		LLM,HAZ,LLW	551	18.02	NA	PTA	A
D007		LLM,HAZ,LLW	551	18.02	NA	PTA	A
D008	LEAD	LLM,HAZ,LLW	551	18.02	NA	PTA	A
D009	MERCURY	LLM,HAZ,LLW	551	18.02	NA	PTA	A
D011	SILVER	LLM,HAZ,LLW	551	18.02	NA	PTA	A
ENDRIN		LLM,HAZ,LLW	551	18.02	NA	PTA	A
D022	CHLOROFORM	LLM,HAZ,LLW	551	18.02	NA	PTA	A
ENDRIN		LLM,HAZ,LLW	551	18.02	NA	PTA	A
ENDRIN		LLM,HAZ,LLW	551	18.02	NA	PTA	A
ENDRIN		LLM,HAZ,LLW	551	18.05	NA	PST	A
ENDRIN		LLM,HAZ,LLW	551	18.06	NA	PST	A
D022	CHLOROFORM	LLM,HAZ,LLW	551	18.06	NA	PST	A
D019	CARBON TET	LLM,HAZ,LLW	551	18.06	NA	PST	A
D011	SILVER	LLM,HAZ,LLW	551	18.06	NA	PST	A
ENDRIN		LLM,HAZ,LLW	551	18.01	NA	PST	A
ENDRIN		LLM,HAZ,LLW	551	18.06	NA	PST	A
D006		LLM,HAZ,LLW	551	18.01	NA	PST	A
D007		LLM,HAZ,LLW	551	18.06	NA	PST	A
D006		LLM,HAZ,LLW	551	18.06	NA	PST	A
D005		LLM,HAZ,LLW	551	18.06	NA	PST	A
D004		LLM,HAZ,LLW	551	18.06	NA	PST	A
ENDRIN		LLM,HAZ,LLW	551	18.05	NA	PST	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC14	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC15	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC16	PSA	A
D001		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC17	PSA	A
D001		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TEST1	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC18	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC19	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC3	PSA	A
D004		LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC8	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC9	PSA	A
D004		NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
D005		NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
D006		NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
D007		NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
D005		LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
D006		LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
D007		LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
D008	LEAD	LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
D009	MERCURY	LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
D011	SILVER	LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
D009	MERCURY	HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
ENDRIN		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
ENDRIN		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
ENDRIN		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
D022	CHLOROFORM	HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
D019	CARBON TET	HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
ENDRIN		NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
ENDRIN		NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
ENDRIN		NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC6	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC7	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM	551PAD	18.03	OUTSIDE	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
D011	SILVER	HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC21	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
D019	CARBON TET	HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
ENDRIN		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
ENDRIN		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
ENDRIN		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
D022	CHLOROFORM	HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
D011	SILVER	HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
D009	MERCURY	HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
D008	LEAD	HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
D007		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC2	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC20	PSA	A
D022	CHLOROFORM	LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
ENDRIN		LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
ENDRIN		LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
ENDRIN		LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
D019	CARBON TET	LLW,LLM,NON,HAZ,LAB	551PAD	18.03	CC4	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
D006		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC5	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
D008	LEAD	HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
D007		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
D006		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
D005		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
D004		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC25	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC24	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	TENT1	PSA	A
D005		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC22	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC1	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC10	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC11	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
D004		HAZ,NON,LLW,LLM,LAB	551PAD	18.03	CC23	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC12	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
D005		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
D006		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
D007		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
D008	LEAD	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
D009	MERCURY	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
D011	SILVER	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
D019	CARBON TET	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
D022	CHLOROFORM	NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC13	PSA	A
D004		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC27	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A

02/17/94

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		NON,HAZ,LLW,LLM,LAB	551PAD	18.03	CC26	PSA	A
ENDRIN		REM	559	90.102	103	PSA	A
D001			559	90.26	103E	PSA	A
D002			559	90.26	103E	PSA	A
D003			559	90.26	103E	PSA	A
D004			559	90.26	103E	PSA	A
D005			559	90.26	103E	PSA	A
D006			559	90.26	103E	PSA	A
D007			559	90.26	103E	PSA	A
D008	LEAD		559	90.26	103E	PSA	A
D009	MERCURY		559	90.26	103E	PSA	A
D010	SELENIUM		559	90.26	103E	PSA	A
D011	SILVER		559	90.26	103E	PSA	A
D018	BENZENE		559	90.26	103E	PSA	A
D019	CARBON TET		559	90.26	103E	PSA	A
D022	CHLOROFORM		559	90.26	103E	PSA	A
D028	1,4-DICHLOROETHANE		559	90.26	103E	PSA	A
D029	1,1-DICHLOROETHENE		559	90.26	103E	PSA	A
D035	MEK		559	90.26	103E	PSA	A
D038	PYRIDINE		559	90.26	103E	PSA	A
D040	TRICHLOROETHYLENE		559	90.26	103E	PSA	A
D043	VINYL CHLORIDE		559	90.26	103E	PSA	A
ENDRIN			559	90.26	103E	PSA	A
ENDRIN			559	90.26	103E	PSA	A
ENDRIN			559	90.26	103E	PSA	A
ENDRIN			559	90.26	103E	PSA	A
ENDRIN			559	90.26	103E	PSA	A
ENDRIN			559	90.26	103E	PSA	A
ENDRIN			559	90.26	103E	PSA	A
ENDRIN			559	90.26	103E	PSA	A
ENDRIN			559	90.26	103E	PSA	A
ENDRIN			559	90.26	103E	PSA	A
D001		REM,TRM,LLM	559	90.29	101	PSA	A
D002		REM,TRM,LLM	559	90.29	101	PSA	A
D003		REM,TRM,LLM	559	90.29	101	PSA	A
D004		REM,TRM,LLM	559	90.29	101	PSA	A
D005		REM,TRM,LLM	559	90.29	101	PSA	A
D006		REM,TRM,LLM	559	90.29	101	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D007		REM,TRM,LLM	559	90.29	101	PSA	A
D008	LEAD	REM,TRM,LLM	559	90.29	101	PSA	A
D009	MERCURY	REM,TRM,LLM	559	90.29	101	PSA	A
D010	SELENIUM	REM,TRM,LLM	559	90.29	101	PSA	A
D011	SILVER	REM,TRM,LLM	559	90.29	101	PSA	A
D018	BENZENE	REM,TRM,LLM	559	90.29	101	PSA	A
D019	CARBON TET	REM,TRM,LLM	559	90.29	101	PSA	A
D022	CHLOROFORM	REM,TRM,LLM	559	90.29	101	PSA	A
D028	1,4-DICHLOROETHANE	REM,TRM,LLM	559	90.29	101	PSA	A
D029	1,1-DICHLOROETHENE	REM,TRM,LLM	559	90.29	101	PSA	A
D035	MEK	REM,TRM,LLM	559	90.29	101	PSA	A
D040	TRICHLOROETHYLENE	REM,TRM,LLM	559	90.29	101	PSA	A
D043	VINYL CHLORIDE	REM,TRM,LLM	559	90.29	101	PSA	A
ENDRIN		REM,TRM,LLM	559	90.29	101	PSA	A
ENDRIN		REM,TRM,LLM	559	90.29	101	PSA	A
ENDRIN		REM,TRM,LLM	559	90.29	101	PSA	A
ENDRIN		REM,TRM,LLM	559	90.29	101	PSA	A
ENDRIN		REM,TRM,LLM	559	90.29	101	PSA	A
ENDRIN		REM,TRM,LLM	559	90.29	101	PSA	A
ENDRIN		REM,TRM,LLM	559	90.29	101	PSA	A
ENDRIN		REM,TRM,LLM	559	90.29	101	PSA	A
ENDRIN		REM,TRM,LLM	559	90.29	101	PSA	A
ENDRIN		REM,TRM,LLM	559	90.29	101	PSA	A
D001		LLW,TRU,RES	559	90.56	103A	PSA	A
D002		LLW,TRU,RES	559	90.56	103A	PSA	A
ENDRIN		REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM,TRM,LLM	559	90.101	102	PSA	A
D001		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D002		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D003		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D004		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D005		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D006		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D007		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D008	LEAD	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D009	MERCURY	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D010	SELENIUM	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D011	SILVER	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D018	BENZENE	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D019	CARBON TET	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D022	CHLOROFORM	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		LLW,TRU,RES	559	90.56	103A	PSA	A
ENDRIN		LLW,TRU,RES	559	90.56	103A	PSA	A
ENDRIN		LLW,TRU,RES	559	90.56	103A	PSA	A
ENDRIN		LLW,TRU,RES	559	90.56	103A	PSA	A
ENDRIN		LLW,TRU,RES	559	90.56	103A	PSA	A
D028	1,4-DICHLOROETHANE	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D029	1,1-DICHLOROETHENE	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM	559	90.102	103	PSA	A
D035	MEK	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D038	PYRIDINE	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D040	TRICHLOROETHYLENE	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D043	VINYL CHLORIDE	REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	559	90.101	102_GB	PSA	A
D001		REM	559	90.102	103	PSA	A
D002		REM	559	90.102	103	PSA	A
D003		REM	559	90.102	103	PSA	A
D004		REM	559	90.102	103	PSA	A
D005		REM	559	90.102	103	PSA	A
D006		REM	559	90.102	103	PSA	A
D007		REM	559	90.102	103	PSA	A
D008	LEAD	REM	559	90.102	103	PSA	A
D009	MERCURY	REM	559	90.102	103	PSA	A
D010	SELENIUM	REM	559	90.102	103	PSA	A
D011	SILVER	REM	559	90.102	103	PSA	A
ENDRIN		LLW,TRU,RES	559	90.56	103A	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D001		REM,TRM,LLM	559	90.101	102	PSA	A
D018	BENZENE	REM	559	90.102	103	PSA	A
D019	CARBON TET	REM	559	90.102	103	PSA	A
D022	CHLOROFORM	REM	559	90.102	103	PSA	A
D028	1,4-DICHLOROETHANE	REM	559	90.102	103	PSA	A
D029	1,1-DICHLOROETHENE	REM	559	90.102	103	PSA	A
D035	MEK	REM	559	90.102	103	PSA	A
D038	PYRIDINE	REM	559	90.102	103	PSA	A
ENDRIN		LLW,TRU,RES	559	90.56	103A	PSA	A
D002		REM,TRM,LLM	559	90.101	102	PSA	A
D003		REM,TRM,LLM	559	90.101	102	PSA	A
D040	TRICHLOROETHYLENE	REM	559	90.102	103	PSA	A
D004		REM,TRM,LLM	559	90.101	102	PSA	A
D003		LLW,TRU,RES	559	90.56	103A	PSA	A
D004		LLW,TRU,RES	559	90.56	103A	PSA	A
D005		LLW,TRU,RES	559	90.56	103A	PSA	A
D006		LLW,TRU,RES	559	90.56	103A	PSA	A
D007		LLW,TRU,RES	559	90.56	103A	PSA	A
D008	LEAD	LLW,TRU,RES	559	90.56	103A	PSA	A
D009	MERCURY	LLW,TRU,RES	559	90.56	103A	PSA	A
D010	SELENIUM	LLW,TRU,RES	559	90.56	103A	PSA	A
D011	SILVER	LLW,TRU,RES	559	90.56	103A	PSA	A
D018	BENZENE	LLW,TRU,RES	559	90.56	103A	PSA	A
D019	CARBON TET	LLW,TRU,RES	559	90.56	103A	PSA	A
D022	CHLOROFORM	LLW,TRU,RES	559	90.56	103A	PSA	A
D028	1,4-DICHLOROETHANE	LLW,TRU,RES	559	90.56	103A	PSA	A
D029	1,1-DICHLOROETHENE	LLW,TRU,RES	559	90.56	103A	PSA	A
D035	MEK	LLW,TRU,RES	559	90.56	103A	PSA	A
D038	PYRIDINE	LLW,TRU,RES	559	90.56	103A	PSA	A
D040	TRICHLOROETHYLENE	LLW,TRU,RES	559	90.56	103A	PSA	A
D043	VINYL CHLORIDE	LLW,TRU,RES	559	90.56	103A	PSA	A
ENDRIN		LLW,TRU,RES	559	90.56	103A	PSA	A
ENDRIN		LLW,TRU,RES	559	90.56	103A	PSA	A
ENDRIN		LLW,TRU,RES	559	90.56	103A	PSA	A
D005		REM,TRM,LLM	559	90.101	102	PSA	A
D006		REM,TRM,LLM	559	90.101	102	PSA	A
D007		REM,TRM,LLM	559	90.101	102	PSA	A
D008	LEAD	REM,TRM,LLM	559	90.101	102	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D043	VINYL CHLORIDE	REM	559	90.102	103	PSA	A
D009	MERCURY	REM,TRM,LLM	559	90.101	102	PSA	A
D010	SELENIUM	REM,TRM,LLM	559	90.101	102	PSA	A
D011	SILVER	REM,TRM,LLM	559	90.101	102	PSA	A
D018	BENZENE	REM,TRM,LLM	559	90.101	102	PSA	A
D019	CARBON TET	REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM	559	90.102	103	PSA	A
ENDRIN		REM	559	90.102	103	PSA	A
ENDRIN		REM	559	90.102	103	PSA	A
D022	CHLOROFORM	REM,TRM,LLM	559	90.101	102	PSA	A
D028	1,4-DICHLOROETHANE	REM,TRM,LLM	559	90.101	102	PSA	A
D035	MEK	REM,TRM,LLM	559	90.101	102	PSA	A
D038	PYRIDINE	REM,TRM,LLM	559	90.101	102	PSA	A
D040	TRICHLOROETHYLENE	REM,TRM,LLM	559	90.101	102	PSA	A
D043	VINYL CHLORIDE	REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM,TRM,LLM	559	90.101	102	PSA	A
ENDRIN		REM	559	90.102	103	PSA	A
ENDRIN		REM	559	90.102	103	PSA	A
ENDRIN		REM	559	90.102	103	PSA	A
ENDRIN		REM	559	90.102	103	PSA	A
ENDRIN		REM	559	90.102	103	PSA	A
D038	PYRIDINE	LLW,LLM,NON	561	10	CC9	PSA	A
D040	TRICHLOROETHYLENE	LLW,LLM,NON	561	10	CC9	PSA	A
D043	VINYL CHLORIDE	LLW,LLM,NON	561	10	CC9	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC9	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC9	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC9	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC9	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC9	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC9	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC9	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC9	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D001		LLM,NON	561	10	OUTSIDE	PSA	A
D002		LLM,NON	561	10	OUTSIDE	PSA	A
D003		LLM,NON	561	10	OUTSIDE	PSA	A
D004		LLM,NON	561	10	OUTSIDE	PSA	A
D005		LLM,NON	561	10	OUTSIDE	PSA	A
D006		LLM,NON	561	10	OUTSIDE	PSA	A
D007		LLM,NON	561	10	OUTSIDE	PSA	A
D008	LEAD	LLM,NON	561	10	OUTSIDE	PSA	A
D009	MERCURY	LLM,NON	561	10	OUTSIDE	PSA	A
D040	TRICHLOROETHYLENE	LLW,LLM	561	10	CC1	PSA	A
D043	VINYL CHLORIDE	LLW,LLM	561	10	CC1	PSA	A
ENDRIN		LLW,LLM	561	10	CC1	PSA	A
ENDRIN		LLW,LLM	561	10	CC1	PSA	A
ENDRIN		LLW,LLM	561	10	CC1	PSA	A
ENDRIN		LLW,LLM	561	10	CC1	PSA	A
ENDRIN		LLW,LLM	561	10	CC1	PSA	A
ENDRIN		LLW,LLM	561	10	CC1	PSA	A
ENDRIN		LLW,LLM	561	10	CC1	PSA	A
ENDRIN		LLW,LLM	561	10	CC1	PSA	A
D001		LLW,LLM	561	10	CC2	PSA	A
D002		LLW,LLM	561	10	CC2	PSA	A
D003		LLW,LLM	561	10	CC2	PSA	A
D004		LLW,LLM	561	10	CC2	PSA	A
D005		LLW,LLM	561	10	CC2	PSA	A
D006		LLW,LLM	561	10	CC2	PSA	A
D007		LLW,LLM	561	10	CC2	PSA	A
D010	SELENIUM	LLM,NON	561	10	OUTSIDE	PSA	A
D011	SILVER	LLM,NON	561	10	OUTSIDE	PSA	A
D018	BENZENE	LLM,NON	561	10	OUTSIDE	PSA	A
D019	CARBON TET	LLM,NON	561	10	OUTSIDE	PSA	A
D028	1,4-DICHLOROETHANE	LLM,NON	561	10	OUTSIDE	PSA	A
D008	LEAD	LLW,LLM	561	10	CC2	PSA	A
D009	MERCURY	LLW,LLM	561	10	CC2	PSA	A
D010	SELENIUM	LLW,LLM	561	10	CC2	PSA	A
D011	SILVER	LLW,LLM	561	10	CC2	PSA	A
D018	BENZENE	LLW,LLM	561	10	CC2	PSA	A
D019	CARBON TET	LLW,LLM	561	10	CC2	PSA	A
D028	1,4-DICHLOROETHANE	LLW,LLM	561	10	CC2	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D029	1,1-DICHLOROETHENE	LLW,LLM	561	10	CC2	PSA	A
D035	MEK	LLW,LLM	561	10	CC2	PSA	A
D038	PYRIDINE	LLW,LLM	561	10	CC2	PSA	A
D040	TRICHLOROETHYLENE	LLW,LLM	561	10	CC2	PSA	A
D043	VINYL CHLORIDE	LLW,LLM	561	10	CC2	PSA	A
ENDRIN		LLW,LLM	561	10	CC2	PSA	A
ENDRIN		LLW,LLM	561	10	CC2	PSA	A
ENDRIN		LLW,LLM	561	10	CC2	PSA	A
ENDRIN		LLW,LLM	561	10	CC2	PSA	A
ENDRIN		LLW,LLM	561	10	CC2	PSA	A
ENDRIN		LLW,LLM	561	10	CC2	PSA	A
ENDRIN		LLW,LLM	561	10	CC2	PSA	A
ENDRIN		LLW,LLM	561	10	CC2	PSA	A
D001		LLW,LLM	561	10	CC3	PSA	A
D002		LLW,LLM	561	10	CC3	PSA	A
D003		LLW,LLM	561	10	CC3	PSA	A
D004		LLW,LLM	561	10	CC3	PSA	A
D005		LLW,LLM	561	10	CC3	PSA	A
D006		LLW,LLM	561	10	CC3	PSA	A
D007		LLW,LLM	561	10	CC3	PSA	A
D008	LEAD	LLW,LLM	561	10	CC3	PSA	A
D009	MERCURY	LLW,LLM	561	10	CC3	PSA	A
D010	SELENIUM	LLW,LLM	561	10	CC3	PSA	A
D011	SILVER	LLW,LLM	561	10	CC3	PSA	A
D018	BENZENE	LLW,LLM	561	10	CC3	PSA	A
D019	CARBON TET	LLW,LLM	561	10	CC3	PSA	A
D028	1,4-DICHLOROETHANE	LLW,LLM	561	10	CC3	PSA	A
D029	1,1-DICHLOROETHENE	LLW,LLM	561	10	CC3	PSA	A
D035	MEK	LLW,LLM	561	10	CC3	PSA	A
D038	PYRIDINE	LLW,LLM	561	10	CC3	PSA	A
D040	TRICHLOROETHYLENE	LLW,LLM	561	10	CC3	PSA	A
D043	VINYL CHLORIDE	LLW,LLM	561	10	CC3	PSA	A
ENDRIN		LLW,LLM	561	10	CC3	PSA	A
ENDRIN		LLW,LLM	561	10	CC3	PSA	A
ENDRIN		LLW,LLM	561	10	CC3	PSA	A
ENDRIN		LLW,LLM	561	10	CC3	PSA	A
D029	1,1-DICHLOROETHENE	LLM,NON	561	10	OUTSIDE	PSA	A
D035	MEK	LLM,NON	561	10	OUTSIDE	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D038	PYRIDINE	LLM,NON	561	10	OUTSIDE	PSA	A
D040	TRICHLOROETHYLENE	LLM,NON	561	10	OUTSIDE	PSA	A
D043	VINYL CHLORIDE	LLM,NON	561	10	OUTSIDE	PSA	A
ENDRIN		LLW,LLM	561	10	CC3	PSA	A
ENDRIN		LLM,NON	561	10	OUTSIDE	PSA	A
ENDRIN		LLM,NON	561	10	OUTSIDE	PSA	A
ENDRIN		LLM,NON	561	10	OUTSIDE	PSA	A
ENDRIN		LLM,NON	561	10	OUTSIDE	PSA	A
ENDRIN		LLM,NON	561	10	OUTSIDE	PSA	A
ENDRIN		LLM,NON	561	10	OUTSIDE	PSA	A
ENDRIN		LLM,NON	561	10	OUTSIDE	PSA	A
ENDRIN		LLM,NON	561	10	OUTSIDE	PSA	A
D001		LLW,LLM	561	10	CC1	PSA	A
D002		LLW,LLM	561	10	CC1	PSA	A
D003		LLW,LLM	561	10	CC1	PSA	A
D004		LLW,LLM	561	10	CC1	PSA	A
D005		LLW,LLM	561	10	CC1	PSA	A
D006		LLW,LLM	561	10	CC1	PSA	A
D007		LLW,LLM	561	10	CC1	PSA	A
D008	LEAD	LLW,LLM	561	10	CC1	PSA	A
D009	MERCURY	LLW,LLM	561	10	CC1	PSA	A
D010	SELENIUM	LLW,LLM	561	10	CC1	PSA	A
D011	SILVER	LLW,LLM	561	10	CC1	PSA	A
D018	BENZENE	LLW,LLM	561	10	CC1	PSA	A
D019	CARBON TET	LLW,LLM	561	10	CC1	PSA	A
D028	1,4-DICHLOROETHANE	LLW,LLM	561	10	CC1	PSA	A
D029	1,1-DICHLOROETHENE	LLW,LLM	561	10	CC1	PSA	A
D038	PYRIDINE	LLW,LLM	561	10	CC1	PSA	A
D035	MEK	LLW,LLM	561	10	CC1	PSA	A
ENDRIN		LLW,LLM	561	10	CC3	PSA	A
ENDRIN		LLW,LLM	561	10	CC3	PSA	A
ENDRIN		LLW,LLM	561	10	CC3	PSA	A
D001		LLW,LLM	561	10	CC4	PSA	A
D002		LLW,LLM	561	10	CC4	PSA	A
D003		LLW,LLM	561	10	CC4	PSA	A
D004		LLW,LLM	561	10	CC4	PSA	A
D005		LLW,LLM	561	10	CC4	PSA	A
D006		LLW,LLM	561	10	CC4	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D007		LLW,LLM	561	10	CC4	PSA	A
D008	LEAD	LLW,LLM	561	10	CC4	PSA	A
D009	MERCURY	LLW,LLM	561	10	CC4	PSA	A
D010	SELENIUM	LLW,LLM	561	10	CC4	PSA	A
D011	SILVER	LLW,LLM	561	10	CC4	PSA	A
D018	BENZENE	LLW,LLM	561	10	CC4	PSA	A
D019	CARBON TET	LLW,LLM	561	10	CC4	PSA	A
D028	1,4-DICHLOROETHANE	LLW,LLM	561	10	CC4	PSA	A
D029	1,1-DICHLOROETHENE	LLW,LLM	561	10	CC4	PSA	A
D035	MEK	LLW,LLM	561	10	CC4	PSA	A
D038	PYRIDINE	LLW,LLM	561	10	CC4	PSA	A
D040	TRICHLOROETHYLENE	LLW,LLM	561	10	CC4	PSA	A
D043	VINYL CHLORIDE	LLW,LLM	561	10	CC4	PSA	A
ENDRIN		LLW,LLM	561	10	CC4	PSA	A
ENDRIN		LLW,LLM	561	10	CC4	PSA	A
ENDRIN		LLW,LLM	561	10	CC4	PSA	A
ENDRIN		LLW,LLM	561	10	CC4	PSA	A
ENDRIN		LLW,LLM	561	10	CC4	PSA	A
ENDRIN		LLW,LLM	561	10	CC4	PSA	A
ENDRIN		LLW,LLM	561	10	CC4	PSA	A
ENDRIN		LLW,LLM	561	10	CC4	PSA	A
D001		LLW,LLM,NON	561	10	CC5	PSA	A
D002		LLW,LLM,NON	561	10	CC5	PSA	A
D003		LLW,LLM,NON	561	10	CC5	PSA	A
D004		LLW,LLM,NON	561	10	CC5	PSA	A
D005		LLW,LLM,NON	561	10	CC5	PSA	A
D006		LLW,LLM,NON	561	10	CC5	PSA	A
D007		LLW,LLM,NON	561	10	CC5	PSA	A
D008	LEAD	LLW,LLM,NON	561	10	CC5	PSA	A
D009	MERCURY	LLW,LLM,NON	561	10	CC5	PSA	A
D010	SELENIUM	LLW,LLM,NON	561	10	CC5	PSA	A
D011	SILVER	LLW,LLM,NON	561	10	CC5	PSA	A
D018	BENZENE	LLW,LLM,NON	561	10	CC5	PSA	A
D019	CARBON TET	LLW,LLM,NON	561	10	CC5	PSA	A
D028	1,4-DICHLOROETHANE	LLW,LLM,NON	561	10	CC5	PSA	A
D029	1,1-DICHLOROETHENE	LLW,LLM,NON	561	10	CC5	PSA	A
D035	MEK	LLW,LLM,NON	561	10	CC5	PSA	A
D038	PYRIDINE	LLW,LLM,NON	561	10	CC5	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D040	TRICHLOROETHYLENE	LLW,LLM,NON	561	10	CC5	PSA	A
D043	VINYL CHLORIDE	LLW,LLM,NON	561	10	CC5	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC5	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC5	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC5	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC5	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC5	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC5	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC5	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC5	PSA	A
D001		LLW,LLM,NON	561	10	CC6	PSA	A
D002		LLW,LLM,NON	561	10	CC6	PSA	A
D003		LLW,LLM,NON	561	10	CC6	PSA	A
D004		LLW,LLM,NON	561	10	CC6	PSA	A
D005		LLW,LLM,NON	561	10	CC6	PSA	A
D006		LLW,LLM,NON	561	10	CC6	PSA	A
D007		LLW,LLM,NON	561	10	CC6	PSA	A
D008	LEAD	LLW,LLM,NON	561	10	CC6	PSA	A
D009	MERCURY	LLW,LLM,NON	561	10	CC6	PSA	A
D010	SELENIUM	LLW,LLM,NON	561	10	CC6	PSA	A
D011	SILVER	LLW,LLM,NON	561	10	CC6	PSA	A
D018	BENZENE	LLW,LLM,NON	561	10	CC6	PSA	A
D019	CARBON TET	LLW,LLM,NON	561	10	CC6	PSA	A
D028	1,4-DICHLOROETHANE	LLW,LLM,NON	561	10	CC6	PSA	A
D029	1,1-DICHLOROETHENE	LLW,LLM,NON	561	10	CC6	PSA	A
D035	MEK	LLW,LLM,NON	561	10	CC6	PSA	A
D038	PYRIDINE	LLW,LLM,NON	561	10	CC6	PSA	A
D040	TRICHLOROETHYLENE	LLW,LLM,NON	561	10	CC6	PSA	A
D043	VINYL CHLORIDE	LLW,LLM,NON	561	10	CC6	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC6	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC6	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC6	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC6	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC6	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC6	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC6	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC6	PSA	A
D001		LLM,LLW,NON	561	10	CC7	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D002		LLM,LLW,NON	561	10	CC7	PSA	A
D003		LLM,LLW,NON	561	10	CC7	PSA	A
D004		LLM,LLW,NON	561	10	CC7	PSA	A
D005		LLM,LLW,NON	561	10	CC7	PSA	A
D006		LLM,LLW,NON	561	10	CC7	PSA	A
D007		LLM,LLW,NON	561	10	CC7	PSA	A
D008	LEAD	LLM,LLW,NON	561	10	CC7	PSA	A
D009	MERCURY	LLM,LLW,NON	561	10	CC7	PSA	A
D010	SELENIUM	LLM,LLW,NON	561	10	CC7	PSA	A
D011	SILVER	LLM,LLW,NON	561	10	CC7	PSA	A
D018	BENZENE	LLM,LLW,NON	561	10	CC7	PSA	A
D019	CARBON TET	LLM,LLW,NON	561	10	CC7	PSA	A
D028	1,4-DICHLOROETHANE	LLM,LLW,NON	561	10	CC7	PSA	A
D029	1,1-DICHLOROETHENE	LLM,LLW,NON	561	10	CC7	PSA	A
D035	MEK	LLM,LLW,NON	561	10	CC7	PSA	A
D038	PYRIDINE	LLM,LLW,NON	561	10	CC7	PSA	A
D040	TRICHLOROETHYLENE	LLM,LLW,NON	561	10	CC7	PSA	A
D043	VINYL CHLORIDE	LLM,LLW,NON	561	10	CC7	PSA	A
ENDRIN		LLM,LLW,NON	561	10	CC7	PSA	A
ENDRIN		LLM,LLW,NON	561	10	CC7	PSA	A
ENDRIN		LLM,LLW,NON	561	10	CC7	PSA	A
ENDRIN		LLM,LLW,NON	561	10	CC7	PSA	A
ENDRIN		LLM,LLW,NON	561	10	CC7	PSA	A
ENDRIN		LLM,LLW,NON	561	10	CC7	PSA	A
ENDRIN		LLM,LLW,NON	561	10	CC7	PSA	A
ENDRIN		LLM,LLW,NON	561	10	CC7	PSA	A
D001		LLW,LLM,NON	561	10	CC8	PSA	A
D002		LLW,LLM,NON	561	10	CC8	PSA	A
D003		LLW,LLM,NON	561	10	CC8	PSA	A
D004		LLW,LLM,NON	561	10	CC8	PSA	A
D005		LLW,LLM,NON	561	10	CC8	PSA	A
D006		LLW,LLM,NON	561	10	CC8	PSA	A
D007		LLW,LLM,NON	561	10	CC8	PSA	A
D008	LEAD	LLW,LLM,NON	561	10	CC8	PSA	A
D009	MERCURY	LLW,LLM,NON	561	10	CC8	PSA	A
D010	SELENIUM	LLW,LLM,NON	561	10	CC8	PSA	A
D011	SILVER	LLW,LLM,NON	561	10	CC8	PSA	A
D018	BENZENE	LLW,LLM,NON	561	10	CC8	PSA	A

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D019	CARBON TET	LLW,LLM,NON	561	10	CC8	PSA	A
D028	1,4-DICHLOROETHANE	LLW,LLM,NON	561	10	CC8	PSA	A
D029	1,1-DICHLOROETHENE	LLW,LLM,NON	561	10	CC8	PSA	A
D035	MEK	LLW,LLM,NON	561	10	CC8	PSA	A
D038	PYRIDINE	LLW,LLM,NON	561	10	CC8	PSA	A
D040	TRICHLOROETHYLENE	LLW,LLM,NON	561	10	CC8	PSA	A
D043	VINYL CHLORIDE	LLW,LLM,NON	561	10	CC8	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC8	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC8	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC8	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC8	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC8	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC8	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC8	PSA	A
ENDRIN		LLW,LLM,NON	561	10	CC8	PSA	A
D001		LLW,LLM,NON	561	10	CC9	PSA	A
D002		LLW,LLM,NON	561	10	CC9	PSA	A
D003		LLW,LLM,NON	561	10	CC9	PSA	A
D004		LLW,LLM,NON	561	10	CC9	PSA	A
D005		LLW,LLM,NON	561	10	CC9	PSA	A
D006		LLW,LLM,NON	561	10	CC9	PSA	A
D007		LLW,LLM,NON	561	10	CC9	PSA	A
D008	LEAD	LLW,LLM,NON	561	10	CC9	PSA	A
D009	MERCURY	LLW,LLM,NON	561	10	CC9	PSA	A
D010	SELENIUM	LLW,LLM,NON	561	10	CC9	PSA	A
D011	SILVER	LLW,LLM,NON	561	10	CC9	PSA	A
D018	BENZENE	LLW,LLM,NON	561	10	CC9	PSA	A
D019	CARBON TET	LLW,LLM,NON	561	10	CC9	PSA	A
D028	1,4-DICHLOROETHANE	LLW,LLM,NON	561	10	CC9	PSA	A
D029	1,1-DICHLOROETHENE	LLW,LLM,NON	561	10	CC9	PSA	A
D035	MEK	LLW,LLM,NON	561	10	CC9	PSA	A
D005		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D018	BENZENE	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D043	VINYL CHLORIDE	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D001		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D002		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D010	SELENIUM	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D011	SILVER	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D019	CARBON TET	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D028	1,4-DICHLOROETHANE	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D029	1,1-DICHLOROETHENE	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D035	MEK	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D038	PYRIDINE	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D006		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D004		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
ENDRIN		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
ENDRIN		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
ENDRIN		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
ENDRIN		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
ENDRIN		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
ENDRIN		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D008	LEAD	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D009	MERCURY	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D007		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D040	TRICHLOROETHYLENE	LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
ENDRIN		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
D003		LAB,TRM,NON,STD,TRU,LLW	569	59	ALL	PSA	A
ENDRIN		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D011	SILVER	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
ENDRIN		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D019	CARBON TET	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D022	CHLOROFORM	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D010	SELENIUM	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
ENDRIN		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
ENDRIN		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D001		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TSC,LAB	664	20	RTR	PSA	A
ENDRIN		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
ENDRIN		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
ENDRIN		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D004		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D009	MERCURY	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D008	LEAD	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D007		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D006		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D005		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D003		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D002		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D001		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D043	VINYL CHLORIDE	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D040	TRICHLOROETHYLENE	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
ENDRIN		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
ENDRIN		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
ENDRIN		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D038	PYRIDINE	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
ENDRIN		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
D038	PYRIDINE	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D002		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
D043	VINYL CHLORIDE	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
D040	TRICHLOROETHYLENE	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
ENDRIN		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
ENDRIN		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
ENDRIN		LLW,LLM,TRU,TRM,NON,LLT,HAZ;TS C,LAB	664	20	RTR	PSA	A
D035	MEK	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
ENDRIN		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
ENDRIN		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
ENDRIN		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
ENDRIN		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS C,LAB	664	20	RTR	PSA	A
D029	1,1-DICHLOROETHENE	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
		C,LAB					
D028	1,4-DICHLOROETHANE	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
ENDRIN		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
ENDRIN		HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D022	CHLOROFORM	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D019	CARBON TET	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D018	BENZENE	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D011	SILVER	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D010	SELENIUM	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D009	MERCURY	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D008	LEAD	LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D007		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D006		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D005		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D004		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D003		LLW,LLM,TRU,TRM,NON,LLT,HAZ,TS	664	20	RTR	PSA	A
		C,LAB					
D035	MEK	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D018	BENZENE	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D029	1,1-DICHLOROETHENE	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D028	1,4-DICHLOROETHANE	HAZ,LLT,LLW,LLM,TRU,TRM,NON	664	20	ALL	PSA	A
D038	PYRIDINE		707	90.105	130B	PSA	A
D040	TRICHLOROETHYLENE		707	90.105	130B	PSA	A
D043	VINYL CHLORIDE		707	90.105	130B	PSA	A
ENDRIN			707	90.105	130B	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN			707	90.105	130B	PSA	A
ENDRIN			707	90.105	130B	PSA	A
ENDRIN			707	90.105	130B	PSA	A
ENDRIN			707	90.105	130B	PSA	A
ENDRIN			707	90.105	130B	PSA	A
ENDRIN			707	90.105	130B	PSA	A
ENDRIN			707	90.105	130B	PSA	A
ENDRIN			707	90.105	130B	PSA	A
ENDRIN			707	90.105	130B	PSA	A
D001		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D002		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D003		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D005		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D006		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D007		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D008	LEAD	REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D009	MERCURY	REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D010	SELENIUM	REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D011	SILVER	REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D018	BENZENE	REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D019	CARBON TET	REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D028	1,4-DICHLOROETHANE	REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D035	MEK	REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D040	TRICHLOROETHYLENE	REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D043	VINYL CHLORIDE	REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM	707	90.106	MODULE_A_GB	PSA	A
D001		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D002		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D003		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D005		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D006		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D007		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D008	LEAD	REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A

DRAFT

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

02/17/94

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D009	MERCURY	REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D010	SELENIUM	REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D011	SILVER	REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D018	BENZENE	REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D019	CARBON TET	REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D028	1,4-DICHLOROETHANE	REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D035	MEK	REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D040	TRICHLOROETHYLENE	REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D043	VINYL CHLORIDE	REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
ENDRIN		REM,TRM,RES,TRU,LLM,LLW	707	90.107	MOD_J	PSA	A
D001			707	90.146	MOD_C_GB_C-40	PSA	A
D002			707	90.146	MOD_C_GB_C-40	PSA	A
D003			707	90.146	MOD_C_GB_C-40	PSA	A
D005			707	90.146	MOD_C_GB_C-40	PSA	A
D006			707	90.146	MOD_C_GB_C-40	PSA	A
D007			707	90.146	MOD_C_GB_C-40	PSA	A
D008	LEAD		707	90.146	MOD_C_GB_C-40	PSA	A
D009	MERCURY		707	90.146	MOD_C_GB_C-40	PSA	A
D010	SELENIUM		707	90.146	MOD_C_GB_C-40	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.28	E-AND-F-HALL	PSA	A
D001			707	90.105	130B	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.28	E-AND-F-HALL	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.28	E-AND-F-HALL	PSA	A
D002			707	90.105	130B	PSA	A
D003			707	90.105	130B	PSA	A
D004			707	90.105	130B	PSA	A
D005			707	90.105	130B	PSA	A
D006			707	90.105	130B	PSA	A
D007			707	90.105	130B	PSA	A
D008	LEAD		707	90.105	130B	PSA	A
D009	MERCURY		707	90.105	130B	PSA	A
D010	SELENIUM		707	90.105	130B	PSA	A
D011	SILVER		707	90.105	130B	PSA	A

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
D018	BENZENE		707	90.105	130B	PSA	A
D019	CARBON TET		707	90.105	130B	PSA	A
D022	CHLOROFORM		707	90.105	130B	PSA	A
D028	1,4-DICHLOROETHANE		707	90.105	130B	PSA	A
D029	1,1-DICHLOROETHENE		707	90.105	130B	PSA	A
D035	MEK		707	90.105	130B	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D011	SILVER		707	90.146	MOD_C_GB_C-40	PSA	A
D018	BENZENE		707	90.146	MOD_C_GB_C-40	PSA	A
D019	CARBON TET		707	90.146	MOD_C_GB_C-40	PSA	A
D022	CHLOROFORM		707	90.146	MOD_C_GB_C-40	PSA	A
D028	1,4-DICHLOROETHANE		707	90.146	MOD_C_GB_C-40	PSA	A
D035	MEK		707	90.146	MOD_C_GB_C-40	PSA	A
D040	TRICHLOROETHYLENE		707	90.146	MOD_C_GB_C-40	PSA	A
D043	VINYL CHLORIDE		707	90.146	MOD_C_GB_C-40	PSA	A
ENDRIN			707	90.146	MOD_C_GB_C-40	PSA	A
ENDRIN			707	90.146	MOD_C_GB_C-40	PSA	A
ENDRIN			707	90.146	MOD_C_GB_C-40	PSA	A
ENDRIN			707	90.146	MOD_C_GB_C-40	PSA	A
ENDRIN			707	90.146	MOD_C_GB_C-40	PSA	A
ENDRIN			707	90.146	MOD_C_GB_C-40	PSA	A
D001		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D002		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D003		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D005		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D006		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D007		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D008	LEAD	REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D009	MERCURY	REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D010	SELENIUM	REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D011	SILVER	REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D018	BENZENE	REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D019	CARBON TET	REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D028	1,4-DICHLOROETHANE	REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D035	MEK	REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D040	TRICHLOROETHYLENE	REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D043	VINYL CHLORIDE	REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
ENDRIN		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A

Page No. 57
02/17/94

APPENDIX 3.7
INDUSTRIAL AREA IM/IRA/DD
PERMITTED STORAGE UNITS

EPA_CODES	CHEM_NAM	WASTE_TYPE	BUILDING	UNIT	ROOM	UNIT_TYPE	STATUS
ENDRIN		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
ENDRIN		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
ENDRIN		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
ENDRIN		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
ENDRIN		REM,TRM,TRU,RES,LLM,LLW	707	90.147	MOD_K_GB_K-45	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D003		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D005		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D006		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D007		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D008	LEAD	RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D009	MERCURY	RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D010	SELENIUM	RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D011	SILVER	RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D018	BENZENE	RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D019	CARBON TET	RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D028	1,4-DICHLOROETHANE	RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D035	MEK	RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D040	TRICHLOROETHYLENE	RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D043	VINYL CHLORIDE	RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
D001		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.28	E-AND-F-HALL	PSA	A
D002		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.28	E-AND-F-HALL	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A
ENDRIN		RES,REM,TRU,LLW,LAB,TRM,LLM	707	90.27	C-AND-D-HALL	PSA	A

(intentionally blank)

APPENDIX 3.8

INDUSTRIAL AREA IM/IRA/DD

OTHER MATERIALS OF CONCERN - RADIONUCLIDES

(intentionally blank)

Appendix 3.8
Other Materials of Concern - Radionuclides

RADIONUCLIDE	BUILDING LOCATION														
Americium	371	374	559	707	771	774	776	777							
Plutonium	371	374	559	707	771	774	776	777	779	886					
Thorium	334	771	881												
Tritium	374	559	561	707	771	774	777	77							
Uranium	331	334	371	374	444	447	559	707	771	776	777	881	883	865	886

(intentionally blank)

4.0 GROUNDWATER MONITORING

Hydrogeologic conditions at RFP were examined to describe the groundwater flow and identify potential contaminant transport pathways. An understanding of potential contaminant sources and hydrogeologic conditions at RFP provides a technical basis for designing a groundwater monitoring system capable of detecting constituents in groundwater and determining their subsequent migration.

4.1 APPROACH

The COPCs identified in Section 3.0 were assigned to general locations in the Industrial Area. Potential migration pathways from these potential source locations were analyzed to assess the adequacy of the existing monitoring network in the Industrial Area.

The conceptual model for groundwater flow in the upper hydrostratigraphic unit was refined based on an analysis of water-level elevations obtained during high (spring 1992) and low (fall 1992) groundwater periods. The influence of building foundations, permeable sandstone units, and bedrock elevations were incorporated into this analysis. Flow maps were generated to predict the potential migration pathways of contaminants.

The emphasis of this IM/IRA is on monitoring potential releases at the perimeter of the Industrial Area and providing early detection of releases. For this purpose, the locations of groundwater monitoring stations must take into account potential sources, the rate of groundwater flow, and groundwater/surface water interactions. Shallow groundwater and surface water are part of an interactive system at RFP, whereby some of the shallow groundwater flows out of the Industrial Area to seeps or springs where it is evapotranspired from hillslopes or joins surface water. Groundwater and surface water is also diverted along trenches, subsurface culverts, and storm water drains to be conveyed to surface drainages or treatment systems. It is also likely that some groundwater discharges at springs will seep back into the ground and return to the

groundwater flow system. It is desirable to monitor groundwater from the upper hydrostratigraphic unit before it leaves the Industrial Area as seeps or springs.

The shallow claystone bedrock (Arapahoe and Laramie Formations), generally considered a confining layer, is believed to be potentially significant to groundwater chemistry in the Industrial Area. Fractures and weathered zones in the bedrock may be important to the occurrence and transport of groundwater constituents. However, fractures are not sufficiently characterized in the Industrial Area to predict their influence on the potential occurrence and migration of chemical constituents. Many building foundations have been excavated into bedrock, and building footing drains are potential pathways for contaminants through bedrock.

4.2 CONCEPTUAL GROUNDWATER FLOW MODEL

The direction and velocity of groundwater flow are important factors in the evaluation of the groundwater monitoring network. The properties of each hydrostratigraphic unit are discussed in the following sections.

4.2.1 Flow in the Upper Hydrostratigraphic Unit

The hydrostratigraphic units at RFP were defined in Section 2.2.5.1. At RFP, the upper hydrostratigraphic unit is considered to be the unconfined saturated zones of the unconsolidated and consolidated water-bearing strata. The upper hydrostratigraphic unit consists of several distinct lithostratigraphic units: Rocky Flats Alluvium, colluvium, valley-fill alluvium, landslide deposits, weathered Arapahoe and Laramie Formation bedrock, and all sandstone units within the Arapahoe and Laramie Formations that are in hydraulic connection with overlying unconsolidated surficial deposits or the ground surface.

The weathered bedrock zone is commonly less than 15 feet thick, throughout the 6,550 acres at RFP, but may extend to 60 feet below the top of bedrock. Its thickness depends on the abundance of fractures, presence of root zones, elevation relative to the water table, and proximity to valley bottoms (EG&G 1993a). For the purpose of creating analyte concentration contour maps, the *Well Evaluation Report* (EG&G 1993a) defined shallow bedrock wells as those in which the top of the screened interval is within the upper 40 feet of bedrock. According to the report, this interval of bedrock includes the weathered portion "where most contamination is thought to occur" (EG&G 1993a).

4.2.1.1 Factors Influencing Groundwater Flow

Groundwater flow in the upper hydrostratigraphic unit is influenced by topography, paleotopography, the permeability of unconsolidated surficial deposits and bedrock, and the distribution of the Arapahoe Formation Number 1 sandstone. Groundwater in the upper hydrostratigraphic unit generally flows away from paleotopographic ridges and along paleotopographic drainages because the subcropping bedrock is mostly claystone and is relatively impermeable. The paleotopographic surface somewhat resembles the present-day topographic surface; ridges and valleys in the top of bedrock correspond to surface ridges and drainages in some areas. However, detailed investigations at OU2 and OU4 revealed that local variations in the top of bedrock surface do not correspond to land surface. The bedrock configuration profoundly influences groundwater flow.

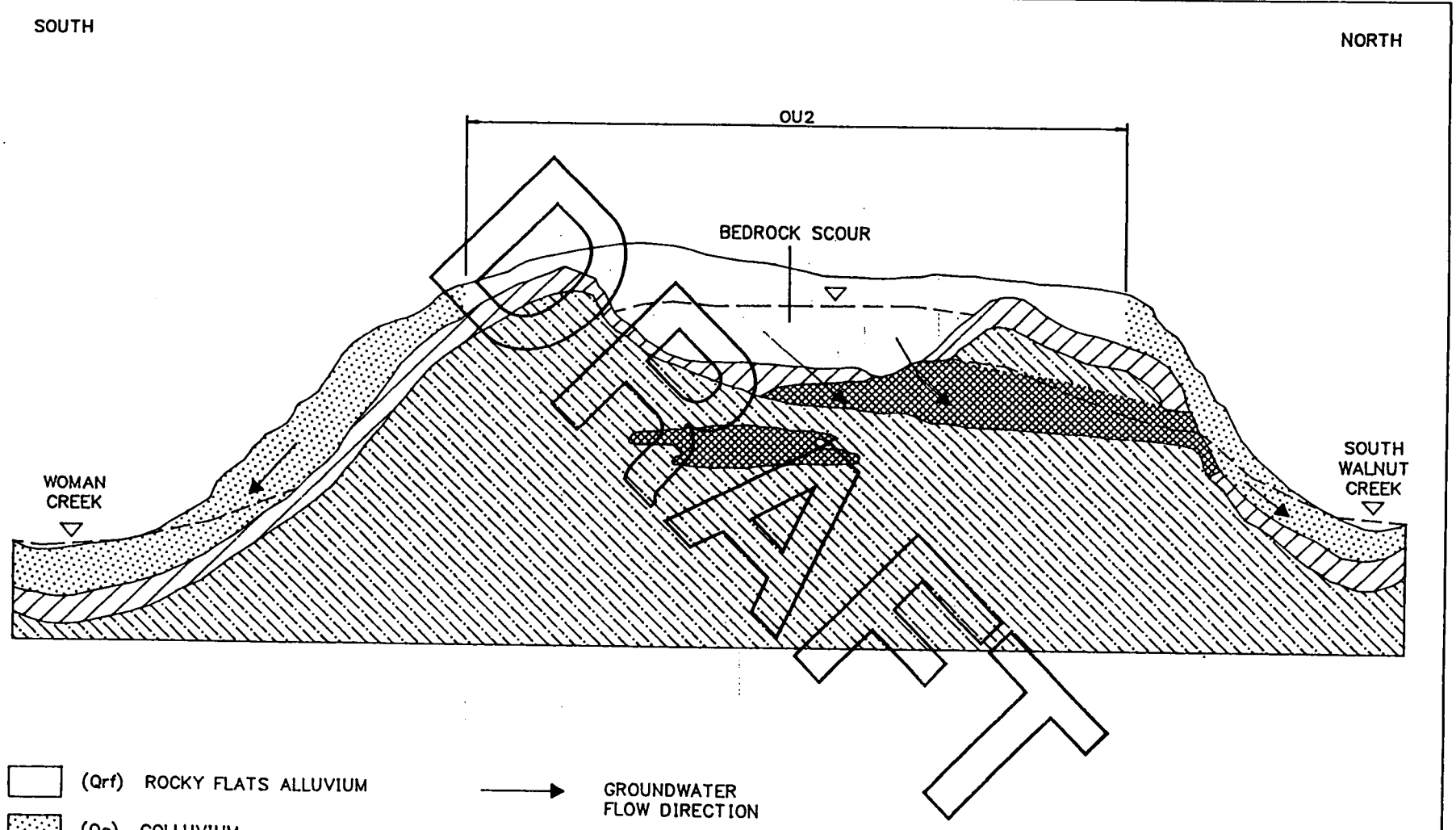
4.2.1.2 Potentiometric Surface Maps

Groundwater potentiometric surface maps of the Industrial Area were constructed for spring and fall 1992 for unconsolidated surficial deposits, and are shown on Plates 4-1 and 4-2. Water-level measurements (Appendix 4.1) were obtained from 145 monitoring wells in and near the Industrial Area during April 1 to 6, 1992, which is considered a historic high-water period. Depths to water were measured in 164 monitoring wells in and near the Industrial Area during October 1 to 5, 1992, a low-water period. Because

depth to water was not measured in all monitoring wells during the five- to six-day time interval, some data gaps exist. The potentiometric surface is defined approximately, and groundwater contours are dashed where inferred. The water-table maps were constructed using mostly monitoring wells completed in alluvium and colluvium, although the weathered bedrock is considered part of the upper hydrostratigraphic unit. The extent of weathering is difficult to determine from the lithologic descriptions in Appendix 4.1 and geologic borehole logs, so data from bedrock wells were generally not used in preparing Plates 4-1 and 4-2, which are located at the end of this document.

Groundwater levels reach their highest elevations in the spring and early summer, when precipitation is high and evapotranspiration is low. Groundwater levels decline during the remainder of the year except for periodic fluctuations in response to precipitation events. The spring 1992 water table elevation in the Industrial Area ranged from an approximate high of 6,040 feet above msl in the west to an approximate low of 5,955 feet msl in the east. Water levels in the saturated alluvium tend to drop slightly in the fall. The October 1992 water-level elevations ranged from approximately 6,035 feet msl in the west to 5,950 feet msl in the east.

The areas of unsaturated alluvium increased in the fall, as indicated on Plates 4-1 and 4-2. The unsaturated areas are located predominantly on the east-west trending ridges of Rocky Flats Alluvium, in the east and east-central portion of the Industrial Area. Limited areas of hillside colluvium were also unsaturated in the fall, southeast and northeast of the Industrial Area. The bifurcated appearance of the unsaturated area in the southeastern Industrial Area in fall 1992 is caused by the influence of subsurface topography. Groundwater collects in depressions and small channels in the bedrock surface that may act as conduits, leaving many higher areas unsaturated, as shown in Figure 4-1. The Arapahoe Formation Number 1 sandstone can be a conduit for groundwater flow beneath higher unsaturated alluvium and bedrock. The sandstone provides groundwater to the hillside colluvium southeast of the Industrial area. In other



Source: EG&G 1993a

U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 4–1
INDUSTRIAL AREA IM/IRA/DD

Schematic Cross Section of Hydrostratigraphy at OU2 Rocky Flats Plant

areas, weathered bedrock is a source or sink for groundwater, so the unsaturated zones do not represent no-flow boundaries.

Groundwater flows perpendicular to the water table contours in an isotropic medium. The arrows on Plates 4-1 and 4-2 indicate that flow is generally eastward. However, groundwater flows to the north along the northern perimeter of the Industrial Area and to the south along the southern boundary. A paleodrainage imparts a northeasterly component to flow east of Building 374; groundwater northwest of Buildings 556 and 559 is expected to flow north-northwest. A south-trending paleodrainage exists south of Building 881. A third paleodrainage trends east in the vicinity of Building 991.

Groundwater flow in colluvium is characterized by steep hydraulic gradient values, on the order of 0.13 feet per foot (ft/ft), toward stream drainages and a highly variable saturated thickness controlled by bedrock topography and proximity to recharge sources (i.e., subsurface discharge from the Rocky Flats Alluvium.) Colluvium recharges valley fill alluvium where groundwater is expected to flow parallel to stream flow and eventually discharge to surface water.

4.2.1.3 Hydraulic Conductivity

The surficial geologic materials are among the more permeable units at RFP. The geometric mean of measured hydraulic conductivity values in the Rocky Flats Alluvium is approximately 10^{-4} centimeters per second (cm/sec) (EG&G 1993i). The geometric mean is a useful approximation because of the logarithmic distribution of hydraulic conductivity values. The measured hydraulic conductivity values, which exhibit a wide range because of the diverse nature of the individual geologic units, are given in Table 4-1.

TABLE 4-1
Industrial Area IM/IRA/DD
Hydraulic Conductivity Values of the Upper Hydrostratigraphic Unit

GEOLOGIC UNIT	HYDRAULIC CONDUCTIVITY (cm/sec)	SOURCE	REMARKS
Rocky Flats Alluvium	1×10^{-4}	EG&G (1993i)	(geometric mean)
Rocky Flats Alluvium	1×10^{-5}	RFP Site Environmental Report (EG&G 1991a)	(average)
subcropping Arapahoe Fm Sandstone	1×10^{-5}	RFP Site Environmental Report (EG&G 1991)	(average)
valley-fill alluvium, Woman Creek	1×10^{-3}	EG&G (1993i)	(geometric mean)
valley-fill alluvium, Walnut Creek	1×10^{-4}	EG&G (1993i)	(geometric mean)
Rocky Flats Alluvium, colluvium, Woman Creek valley fill alluvium	9×10^{-7} to 2.9×10^{-2}	OU1 Phase III RFI/RI field investigation	(measured range)
Arapahoe Fm Number 1 sandstone	4.9×10^{-6} to 6.2×10^{-1}	multiple well pump testing in OU2	(measured range)
Rocky Flats Alluvium + subcropping Arapahoe Fm Number 1 sandstone	3.9×10^{-3} to 1.24	OU2 Phase II RFI/RI field investigation	(measured range)
weathered bedrock	10^{-5} to 10^{-5}	*Well Evaluation Report* (EG&G 1993a)	
weathered bedrock	5×10^{-7} to 3×10^{-5} or less	OU1 slug tests	(measured)

Notes:
cm/sec = centimeters per second
Fm = Formation
OU = operable unit
RFP = Rocky Flats Plant

4.2.2 Flow in the Lower Hydrostratigraphic Unit

The lower hydrostratigraphic unit is composed of unweathered bedrock of the Arapahoe and Laramie Formations. Water-level elevations in lower hydrostratigraphic unit

monitoring wells are lower in the east, when wells screened at approximately the same depth in bedrock are compared. The eastward direction of flow reflects the dip of the strata. Flow volumes are probably low because of the low hydraulic conductivity of the weathered bedrock.

The lower hydrostratigraphic unit hydraulic conductivities are generally lower than those of the overlying upper hydrostratigraphic unit because of the higher percentage of fine-grained material. Reported hydraulic conductivity values are given in Table 4-2. The type of test used to estimate hydraulic conductivities is noted, if known.

TABLE 4-2
Industrial Area IM/IRA/DD
Hydraulic Conductivity Values of the Lower Hydrostratigraphic Unit

GEOLOGIC UNIT	HYDRAULIC CONDUCTIVITY (cm/sec)	SOURCE	REMARKS
unweathered bedrock sandstone	1 x 10^{-6}	RFP Site Environmental Monitoring Report (EG&G 1993c)	(average)
weathered and unweathered claystone	1 x 10^{-8} to 10^{-7}	RFP Site Environmental Monitoring Report (EG&G 1993c)	
unweathered claystone bedrock	1 x 10^{-8} to 10^{-6}	Well Evaluation Report (EG&G 1993a)	
unweathered bedrock	2.4 x 10^{-8} to 4.5 x 10^{-6}	Groundwater Protection and Monitoring Program Plan (EG&G 1993j)	packer tests

The hydraulic conductivities of unweathered bedrock generally range from 1 x 10^{-8} to 1 x 10^{-6} to cm/sec (3 x 10^{-5} to 3 x 10^{-3} feet per day [ft/day]). The Laramie Formation sandstones are expected to have hydraulic conductivities between those of the Number 1 sandstone and the unweathered siltstones and claystones. The Laramie Formation sandstones are approximately 15 feet or thick or less, except where sandstone channel

deposits are stacked or coalesced. Generally, these sandstones are laterally discontinuous.

4.2.3 Flow in the Laramie-Fox Hills Aquifer

Below RFP, groundwater in the Laramie-Fox Hills aquifer flows from the outcrop recharge area west of RFP to deeper parts of the aquifer to the east (Robson et al. 1981). The hydraulic gradient, approximately 0.025 ft/ft to the east, is in part a reflection of the regional dip of the strata. The average hydraulic conductivity measured northeast of RFP ranges from 0.01 to 0.04 ft/day (3.5×10^{-6} to 1.4×10^{-5} cm/sec) (Robson 1983).

4.2.4 Vertical Groundwater Flow

Groundwater at RFP flows in both the horizontal and vertical directions. The direction of vertical flow (downward or upward) and degree of hydraulic connection between lithostratigraphic or hydrostratigraphic units is important in evaluating potential pathways.

4.2.4.1 Vertical Hydraulic Gradients

Downward vertical gradients have been documented in the Industrial Area topographic highs (EG&G 1993a). The 1993 Well Evaluation Report examined cross sections and well cluster hydrographs to assess the hydraulic connection and hydraulic gradients between alluvial and bedrock wells. The spring 1992 water levels in wells in the unconsolidated surficial deposits were higher than those in the bedrock wells, indicating a downward vertical gradient in the central Industrial Area.

Upward hydraulic gradients were identified in well clusters located in the topographically low areas near the bottoms of drainages (EG&G 1993a). Data were limited but suggest that groundwater in the bedrock may recharge unconsolidated surficial deposits in stream drainages, as schematically shown in Figure 4-2. Because vertical hydraulic connection

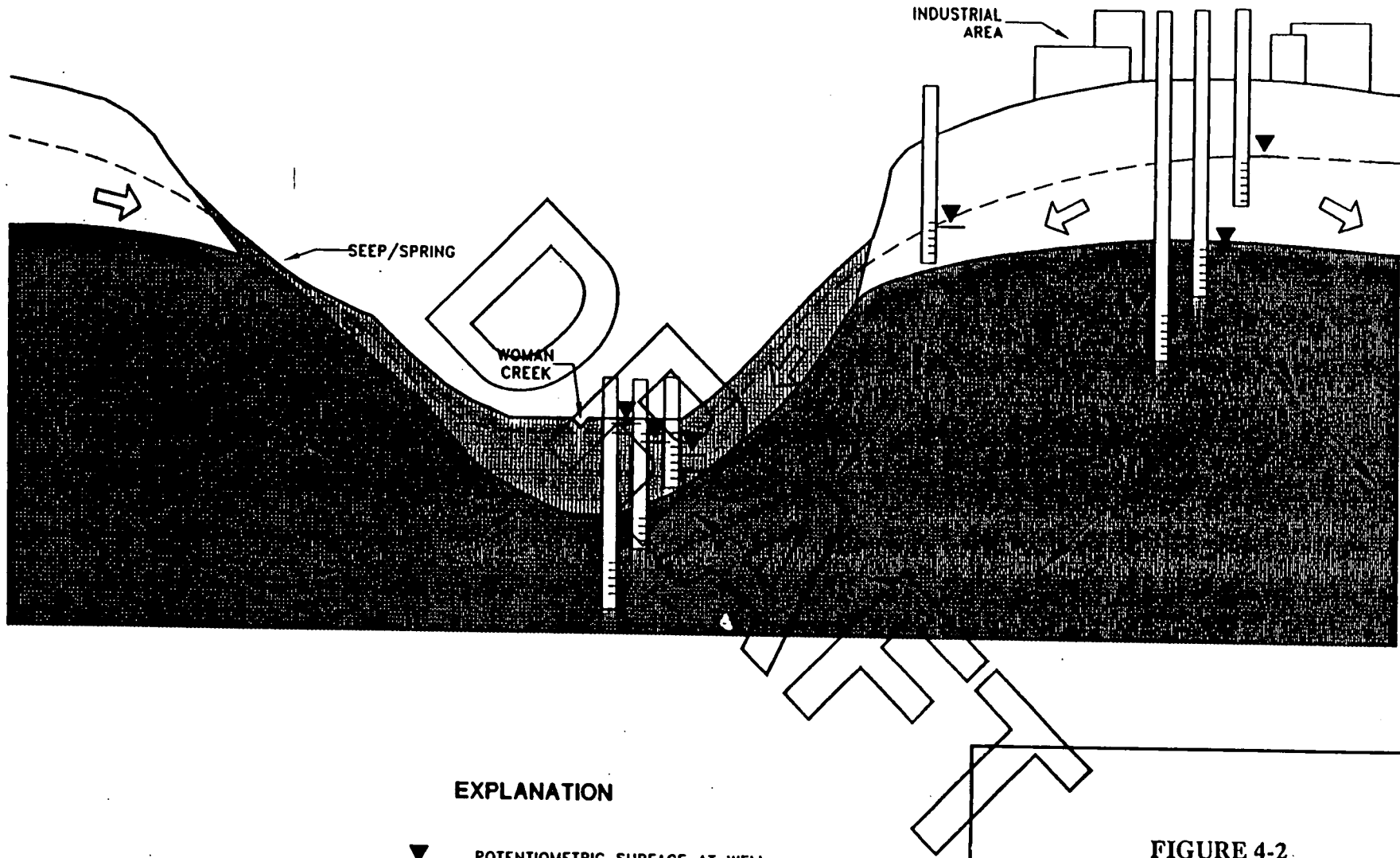


FIGURE 4-2
Industrial Area IM/IRA/DD
Conceptual Diagram of Groundwater Flow in Industrial Area and Adjacent Drainage, Rocky Flats Plant

between bedrock and alluvium is relatively poor, flow volume is likely to be limited (EG&G 1993a). Most well cluster hydrographs showed poor hydraulic connection between the bedrock and unconsolidated surficial deposits. The study concluded that the deeper hydrostratigraphic units at RFP (typically greater than 100 feet deep) are generally not in direct hydraulic connection with the upper hydrostratigraphic unit (EG&G 1993a). This lack of direct hydraulic connection indicates that groundwater from the upper hydrostratigraphic unit will not quickly nor easily migrate downward to the lower hydrostratigraphic unit, despite downward vertical gradients.

Vertical hydraulic gradient values on the order of 0.79 to 1.05 ft/ft have been estimated between the colluvium and bedrock sandstones at OU1 (EG&G 1993j). The amount of flow through claystone is assumed to be small, based on the fine-grained lithology and limited occurrence of fractures at depth observed in cores. Fracturing, where evident, is most abundant in the weathered bedrock zone. Cores from borings in the 1991/1992 site-wide drilling program indicate that fractures (1) occurred individually and in discrete zones, (2) were often oblique to near vertical, (3) exhibited iron-staining in the upper portion of the bedrock, and (4) appeared to decrease with depth.

Regional water-level elevations indicate that a strong downward vertical gradient also exists between the upper hydrostratigraphic unit and the Laramie-Fox Hills aquifer. In the RFP area, the potentiometric surface in the Laramie-Fox Hills aquifer is 50 to 100 feet lower than the water level in the overlying alluvium (Robson et al. 1981). However, the thick Laramie Formation claystone and siltstone prevent direct connection between surficial groundwater and the Laramie-Fox Hills aquifer.

4.2.4.2 Vertical Hydraulic Conductivities

Vertical hydraulic conductivity values may be three times less than horizontal hydraulic conductivity values in clays and shales (Freeze and Cherry 1979). Therefore, the vertical hydraulic conductivity of the lower hydrostratigraphic unit bedrock strata could be on the

order of 1 x 10^{-9} to 1 x 10^{-8} to cm/sec (3 x 10^{-6} to 3 x 10^{-5} ft/day). Although fracturing and more permeable zones could contribute to higher vertical conductivities than estimated, the low vertical hydraulic conductivities and the adsorptive properties of clay materials are expected to retard the downward movement of chemical constituents.

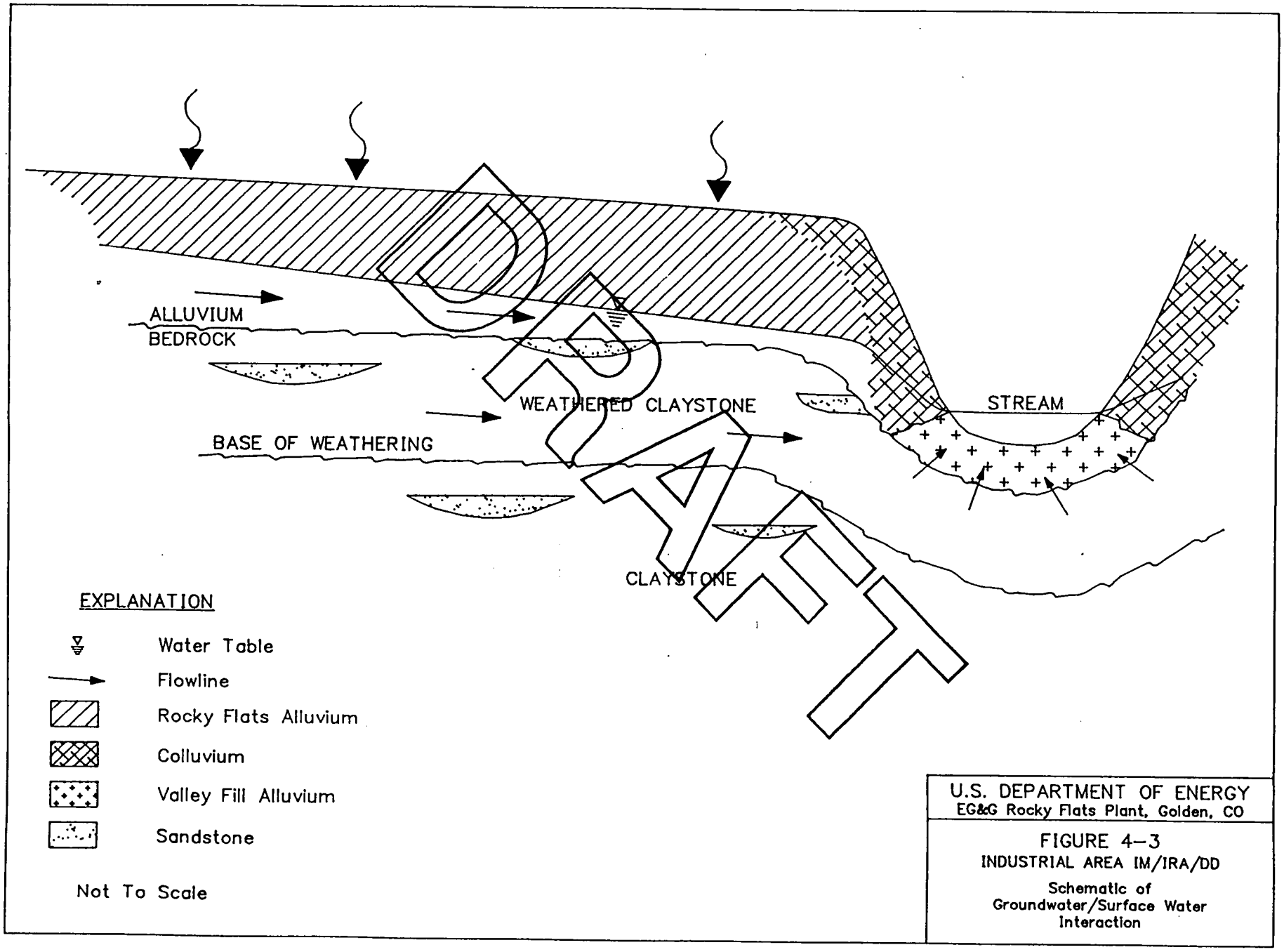
4.2.5 Groundwater/Surface Water Interaction

Groundwater from the upper hydrostratigraphic unit discharges at springs and seeps on the hillsides of the Industrial Area at the contact between the alluvium and bedrock and where shallow sandstones crop out in the drainages. Seeps and associated wetlands are indicated on Plates 4-1 and 4-2, based on U.S. Geological Survey (USGS) 1:24,000 scale mapping, circa 1980. A new surficial deposits map, showing seeps and springs, will be published by EG&G in the spring of 1994. Water at seeps is either consumed by evapotranspiration or flows downslope as surface flow or through colluvial deposits to south Walnut or Woman creeks. A conceptual cross section, showing surface water infiltration on topographic highs and discharge at seeps and springs, is shown in Figure 4-3. The interrelationship of surface water and groundwater is an important consideration for environmental monitoring at RFP.

4.3 EXISTING MONITORING PROGRAMS

Groundwater monitoring is one component of the larger RFP groundwater program. The objectives of the overall groundwater program are as follows:

- Prevent further degradation of the upper hydrostratigraphic unit.
- Ensure compliance with regulations.
- Clean up existing contamination.
- Monitor existing conditions.



U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 4–3
INDUSTRIAL AREA IM/IRA/DD

Schematic of
Groundwater/Surface Water
Interaction

c:\rfets\sw\SWF1C43.dwg 06H60300

The groundwater monitoring program at RFP is largely defined by regulatory requirements. Groundwater monitoring is performed under several different programs, which are conceptually linked under the Groundwater Protection and Monitoring Program (GPMP). The GPMP implements a groundwater monitoring plan designed to satisfy a wide array of regulatory requirements, including DOE Order 5400.1, RCRA, and CERCLA. Additional requirements are specified by the IAG, the AIP, and other applicable regulations.

4.3.1 Purposes for Groundwater Monitoring

The purposes of the RFP groundwater monitoring program are to determine background analyte values, measure the concentrations of hazardous and nonhazardous constituents, and assess the rate of movement and extent of any contaminant plumes. Wells in the monitoring program are divided into six subsets on the basis of purpose and regulatory requirements. These subsets, along with their monitoring objectives, are as follows:

- Background Monitoring - to detect levels of chemical constituents in groundwater at locations not affected by RFP activities.

- RCRA Regulatory Monitoring - to monitor the upper hydrostratigraphic unit within and immediately adjacent to a RCRA OU.

- RCRA Characterization Monitoring - to characterize and/or monitor hydrostratigraphic units other than the upper hydrostratigraphic unit at or near RCRA units.

- CERCLA Monitoring - to characterize groundwater and the extent and movement of constituents as part of RI/FS activities in compliance with CERCLA remediation requirements.

- Boundary Monitoring - to monitor groundwater movement and quality at the RFP boundaries, downgradient of RFP affected areas.

- Special Purpose Monitoring - includes other wells installed at the RFP that are used to characterize groundwater and hydrogeology for a variety of purposes.

4.3.2 Wells Monitored and Sampling Frequency

Currently, there are 371 active wells and 84 piezometers in the RFP groundwater monitoring network (EG&G 1993j). An additional 196 wells are inactive or have been abandoned since the first monitoring wells were installed in the 1950s.

Water-level measurements are obtained each quarter for every one of the 455 active wells and piezometers, and monthly in approximately 95 wells and piezometers. Groundwater samples are collected quarterly from all active wells in the monitoring network. Table 4-3 lists each monitoring well in the Industrial Area (as of October 14, 1993), the status of the well (active, inactive, or abandoned), the program to which the well belongs (RCRA, CERCLA, Background, Boundary, or Special Purpose), and the sampling frequency (quarterly or not sampled). All active wells are measured for water levels but may or may not be sampled.

The monitoring well network undergoes constant evaluation to determine the most effective approach to sampling groundwater at RFP. This evaluation takes into account current regulations and streamlines the sampling program to meet those requirements in the most efficient manner.

TABLE 4-3
Industrial Area IM/IRA/DD
Status of Monitoring Wells in the Industrial Area at Rocky Flats Plant
October 14, 1992

	WELL NAME	STATE NORTH	STATE EAST	GENERAL AREA	WELL STATUS	WELL CLASS	S. FR	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP BEDROCK
1	0260	751181	2085023	PA	ABANDONED				5934.6	5935.01	22.6			
2	0360	750889	2085491	PA	ABANDONED				5957.2		20.2			
3	0460	750574	2085531	PA	ABANDONED				5962.0	5972.72	17.7			
4	0560	750308	2085404	PA	ABANDONED				5966.4		19.4			
5	0660	750124	2084921	PA	ABANDONED				5972.6		28.8			
6	0266	751062	2085681	PA	ABANDONED				5949.4		139.7			
7	0168	749242	2085581	PA	ABANDONED				5977.2		4.0			
8	0268	748887	2085579	PA	ABANDONED				5979.6		4.0			
9	0368	748887	2085957	PA	ABANDONED				5974.5		4.0			
10	0468	749241	2085957	PA	ABANDONED				5973.3		4.0			
11	0271	748513	2085950		ABANDONED				5936.2	5936.79	28.6			
12	0174	749626	2086195		ABANDONED				5968.0	5968.80	24.2			
13	0974	748028	2084783		ABANDONED				5925.1	5926.25	19.0			
14	1074	747988	2084705		ABANDONED				5925.8	5925.91	9.9			
15	2174	748990	2082636		ABANDONED				6026.6		258.0			
16	0681	750859	2082503	PA	ABANDONED				6004.4	6005.70	30.6			
17	0781	750860	2082539	PA	ABANDONED				6004.1	6006.06	29.4			
18	1986	750894	2083296	Solar Pond	ACTIVE	Special Purpose	N	Kclst	5943.1	5943.86	12.3	3.0	12.3	11.5
19	2086	751112	2084358	Solar Pond	ABANDONED			fill	5960.5	5962.12	10.6	4.2	10.6	12.5
20	2186	750855	2082501	Plant North	ACTIVE	Special Purpose	N	Kss & Kaltclst	6004.8	6005.96	67.3	35.0	67.2	15.0
21	2286	750718	2084411	Solar Pond	ACTIVE	RCRA	Q	Qrf	5978.8	5979.55	11.2	3.2	11.2	11.0
22	2386	750338	2084259	Solar Pond	ACTIVE	RCRA-C	Q	Kslt & Kaltclst	5982.5	5982.46	117.3	113.0	117.3	8.2
23	2486	750338	2084277	Solar Pond	ACTIVE	RCRA	Q	Qrf	5982.5	5983.56	7.5	3.0	7.5	7.2
24	2586	750412	2084831	Solar Pond	ACTIVE	RCRA-C	Q	Kaltclst & Kclst	5975.2	5977.14	82.0	59.9	82.0	8.0
25	2686	750411	2084841	Solar Pond	ACTIVE	RCRA	Q	Qrf	5975.4	5977.17	11.0	3.8	11.0	10.5
26	2786	750781	2085238	Solar Pond	ACTIVE	RCRA-C	Q	Kssslts & Kscist	5962.9	5963.88	133.0	128.5	133.0	11.0
27	2886	750803	2085240	Solar Pond	ABANDONED			Qrf	5962.4	5964.38	8.6	4.0	8.6	8.5
28	2986	750599	2085687	Solar Pond	ACTIVE	RCRA	Q	Qrf	5959.6	5960.68	8.8	2.8	8.8	8.5
29	3086	751078	2084921	Solar Pond	ACTIVE	RCRA	Q	Kclst	5957.4	5958.39	14.9	2.5	14.9	2.5
30	3186	751051	2084764	Solar Pond	ACTIVE	RCRA	N	Kss & Kslt	5965.0	5967.05	17.3	2.5	17.3	0.5
31	3286	751050	2084743	Solar Pond	ACTIVE	RCRA-C	Q	Kss & Kslss	5966.1	5967.92	125.5	114.9	125.5	1.0
32	3386	749950	2085003	Mound Area	ACTIVE	RCRA	Q	Qrf	5951.4	5952.42	7.3	3.0	7.3	6.8
33	3486	750162	2086193	East Trenches	ACTIVE	CERCLA	Q	Kcss & Kcslt	5912.0	5913.95	56.3	44.2	56.3	16.0
34	3586	750167	2086219	East Trenches	ACTIVE	CERCLA	Q	Qc	5910.8	5912.76	11.6	4.9	11.6	10.5

TABLE 4-3
Industrial Area IM/IRA/DD
Status of Monitoring Wells in the Industrial Area at Rocky Flats Plant
October 14, 1992

	WELL NAME	STATE NORTH	STATE EAST	GENERAL AREA	WELL STATUS	WELL CLASS	S. FR	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP BEDROCK
35	4386	749404	2085869	Mound Area	ACTIVE	CERCLA	Q	Qrf	5972.9	5974.46	16.8	4.0	16.8	17.0
36	4486	749254	2082234	Plant West	ACTIVE	Special Purpose	N	Qrf	6019.9	6021.96	26.3	3.2	26.3	25.5
37	6186	749198	2083717	881 Hillside	ACTIVE	Special Purpose	N	Qrf	5999.5	6000.60	12.3	5.0	12.0	11.5
38	0187	748127	2083653	881 Hillside	ACTIVE	CERCLA	Q	fill	5992.5	5994.08	12.1	3.4	11.8	11.8
39	0587	748081	2084849	881 Hillside	ACTIVE	CERCLA	Q	Kss & Kscltss	5927.9	5929.99	51.5	42.0	51.3	11.0
40	0987	749068	2085348	903 Pad	ACTIVE	CERCLA	Q	Kss	5980.2	5981.70	32.4	14.5	32.2	12.5
41	1087	748946	2085290	903 Pad	ACTIVE	CERCLA	Q	Qrf	5982.0	5983.52	12.0	3.5	12.0	11.3
42	1287	748581	2086066	903 Pad	ACTIVE	CERCLA	Q	Kcslt	5934.8	5936.30	10.2	4.9	10.0	3.5
43	1587	749011	2086249	903 Pad	ACTIVE	CERCLA	Q	Qrf	5971.3	5972.79	22.5	5.8	22.1	21.9
44	1687	749130	2086249	903 Pad	ACTIVE	CERCLA	Q	Kslt	5969.5	5970.79	125.2	100.0	125.0	22.2
45	1787	749415	2086308		ABANDONED			Qrf	5968.0	5969.56	25.8	3.5	25.5	25.0
46	1887	749404	2086339	Mound Area	ACTIVE	CERCLA	Q	Kss & Kcslt	5968.0	5969.49	133.7	127.0	133.5	25.2
47	1987	749623	2086171	Mound Area	ACTIVE	CERCLA	Q	Qrf	5968.4	5969.91	11.9	3.5	11.7	10.8
48	2087	749634	2086155	Mound Area	ACTIVE	CERCLA	N	Kscltclst	5968.7	5970.14	116.4	107.3	116.1	11.8
49	2187	749969	2085799	Mound Area	ACTIVE	CERCLA	Q	Qc	5928.4	5929.69	10.6	3.3	10.4	8.0
50	2287	749924	2085822	Mound Area	ACTIVE	CERCLA	Q	Kss & Kslt	5931.2	5932.80	88.7	81.4	88.5	12.8
51	2387	749404	2085910	Mound Area	ACTIVE	CERCLA	N	Kscltss & Kcslst	5972.8	5974.49	37.9	17.2	37.6	15.2
52	3787	750494	2085224		ABANDONED			Qrf	5967.5	5968.99	9.0	3.5	8.8	8.0
53	3887	750396	2085094	Solar Pond	ACTIVE	RCRA	Q	Qrf	5972.2	5973.90	9.5	3.5	9.3	7.8
54	3987	751081	2085268		ACTIVE	RCRA-C	Q	Kscslt & Kcslst	5947.0	5948.42	117.4	110.0	117.1	3.5
55	4387	748030	2084788	881 Hillside	ACTIVE	CERCLA	N	Qc	5925.1	5926.41	12.5	3.5	12.3	12.0
56	4487	748306	2085435	903 Pad	ACTIVE	CERCLA	N	Qc	5949.6	5951.10	3.7	1.5	3.5	3.2
57	4587	748313	2085451	903 Pad	ACTIVE	CERCLA	Q	Kss & Kslt & Kcslst	5949.3	5950.91	101.3	89.5	97.1	4.0
58	5187	748103	2083850	881 Hillside	ACTIVE	CERCLA	Q	fill?	5963.8	5965.22	14.0	3.6	13.8	12.5
59	5287	748145	2084067	881 Hillside	ACTIVE	CERCLA	Q	fill?	5967.9	5969.57	20.5	3.5	20.3	20.0
60	5687	750638	2084423	Solar Pond	ACTIVE	RCRA	Q	Qrf	5978.4	5979.77	9.9	3.5	9.7	9.4
61	B208089	751143	2085876	Solar Pond	ACTIVE	RCRA	Q	Qc	5935.4	5937.07	14.2	3.4	12.9	12.2
62	B208189	751138	2085885	Solar Pond	ACTIVE	RCRA	Q	Kcslst	5935.4	5937.46	27.6	16.9	26.3	11.0
63	P114389	750990	2081739	Plant	ACTIVE	Special Purpose	N	Qrf	5991.2	5993.17	15.8	10.1	14.5	14.0
64	P114489	750337	2081246	Plant	ACTIVE	Special Purpose	N	Qrf	6033.4	6035.43	50.1	44.4	48.8	48.3
65	P114589	750396	2081731	Plant	ACTIVE	Special Purpose	N	Qrf	6024.1	6025.90	37.6	32.5	36.5	27.5
66	P114689	749943	2083044		ACTIVE			Qrf	6004.0	6005.76	23.5	17.8	22.2	22.0
67	P114789	749940	2082610	Plant	ACTIVE	Special Purpose	N	Qrf	6010.7	6012.40	27.6	21.8	26.2	26.0
68	P114889	749926	2082127	Plant	ACTIVE	Special Purpose	N	Qrf	6016.6	6018.26	15.6	9.9	14.3	13.8

TABLE 4-3
Industrial Area IM/IRA/DD
Status of Monitoring Wells in the Industrial Area at Rocky Flats Plant
October 14, 1992

	WELL NAME	STATE NORTH	STATE EAST	GENERAL AREA	WELL STATUS	WELL CLASS	S. FR	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP BEDROCK
69	P114989	749959	2081661	Plant	ACTIVE	Special Purpose	N	Qrf	6029.8	6031.84	39.3	33.6	38.0	37.5
70	P115089	749930	2081258	Plant	ACTIVE	Special Purpose	N	Qrf	6038.1	6040.10	42.0	36.3	40.7	40.2
71	P115489	749507	2082135	Plant	ACTIVE	Special Purpose	N	Qrf	6023.4	6025.10	27.8	22.1	26.5	26.0
72	P115589	749551	2082658	Plant	ACTIVE	Special Purpose	N	Qrf	6014.1	6015.77	30.7	25.1	29.5	29.0
73	P115689	749532	2083019	Plant	ACTIVE	Special Purpose	N	Qrf	6006.9	6008.71	21.3	16.2	20.2	19.7
74	P119389	750280	2081921	Plant	ACTIVE	Special Purpose	N	Qrf	6011.7	6013.18	18.2	12.5	16.9	16.4
75	P207389	750195	2084468	Solar Pond	ACTIVE	RCRA	Q	Kss & Kclst	5981.0	5982.77	16.2	10.5	15.2	7.0
76	P207489	750197	2084481	Plant	ABANDONED			Qrf	5980.7	5982.64	8.2	2.4	7.0	6.5
77	P207589	750395	2084843	Solar Pond	ACTIVE	RCRA	N	Ksltclst	5974.1	5975.96	25.1	14.4	23.9	9.4
78	P207689	750398	2085318	Solar Pond	ACTIVE	RCRA	Q	Qrf	5966.3	5967.88	14.4	3.6	13.1	12.6
79	P207789	750392	2085343	Solar Pond	ACTIVE	RCRA	Q	Ksltclst	5965.9	5967.75	28.6	17.9	27.3	12.9
80	P207889	750671	2085343	Solar Pond	ACTIVE	RCRA	Q	Qrf	5962.8	5964.90	9.0	3.3	7.7	8.5
81	P207989	750671	2085330	Solar Pond	ACTIVE	RCRA	Q	Kclst	5963.1	5965.17	21.7	11.0	20.5	5.8
82	P208889	751086	2085249	Solar Pond	ACTIVE	RCRA-C	Q	Ksltclst	5947.3	5949.25	99.2	87.8	96.9	5.5
83	P208989	751044	2084839	Solar Pond	ACTIVE	RCRA	Q	Kstss & Ksltclst	5962.5	5964.56	26.1	15.4	24.8	3.5
84	P209089	750566	2084910	Solar Pond	ACTIVE	RCRA	Q	Ksltclst	5972.2	5974.25	27.2	16.5	26.0	11.5
85	P209189	750762	2084309	Solar Pond	ACTIVE	RCRA	N	Kss & Ksltclst	5980.7	5982.21	36.1	13.3	35.0	10.3
86	P209289	750863	2084139	Solar Pond	ACTIVE	RCRA	Q	Qrf	5981.6	5983.42	13.4	8.2	12.7	12.2
87	P209389	750864	2084130	Solar Pond	ACTIVE	RCRA	Q	Kss & Kstss & Kcss	5981.5	5983.39	30.1	16.8	28.8	13.8
88	P209489	750991	2084634	Solar Pond	ACTIVE	RCRA	Q	Kss & Kstss	5978.0	5980.10	36.3	15.5	35.0	9.0
89	P209589	751071	2085286	Solar Pond	ACTIVE	RCRA	Q	Ksltclst & Kclst	5948.2	5950.04	19.8	9.1	18.5	4.1
90	P209689	750533	2085514	Solar Pond	ACTIVE	RCRA	Q	Ksltclst	5962.6	5964.43	27.9	17.2	26.7	12.2
91	P209789	750579	2085481	Solar Pond	ACTIVE	RCRA	Q	Qrf	5962.8	5964.94	13.8	3.0	12.5	12.0
92	P209889	751194	2084984	Solar Pond	ACTIVE	RCRA	Q	Ksltclst	5940.5	5942.40	19.6	8.9	18.3	3.9
93	P209989	751565	2084649	Solar Pond	ACTIVE	RCRA	N	Qc	5898.1	5900.40	9.6	3.8	8.2	7.7
94	P210089	751564	2084639	Solar Pond	ACTIVE	RCRA	Q	Ksltclst	5898.4	5900.40	22.9	12.2	21.5	7.2
95	P210289	750564	2085223	Solar Pond	ABANDONED			Ksltclst	5967.0	5969.19	22.3	11.6	21.0	6.6
96	P213689	749460	2083736	Plant	ACTIVE	Special Purpose	N	Qrf	5994.3	5996.04	14.8	9.1	13.5	13.0
97	P213889	750466	2086109	Plant	ACTIVE	RCRA	N	Kss & Kcss	5954.1	5955.94	22.0	11.3	20.8	8.0
98	P213989	750468	2086102	Plant	ACTIVE	RCRA	N	Qrf	5954.3	5956.38	7.2	3.3	6.9	6.7
99	P215789	749470	2083430	Plant	ACTIVE	Special Purpose	N	Qrf	6002.0	6003.66	19.6	14.5	18.5	18.0
100	P218089	749941	2084020	OPWL	ACTIVE	Special Purpose	Q	Qrf	5985.8	5987.55	8.7	3.0	7.4	6.0
101	P218389	750831	2085648	Plant	ACTIVE	RCRA	N	Qrf	5956.2	5958.45	13.8	8.1	12.5	12.0
102	P219089	751127	2084117	Plant	INACTIVE	Special Purpose	N	Qc, Kclst & Ksltclst	5949.1	5949.90	15.7	5.0	14.4	10.4

TABLE 4-3
Industrial Area IM/IRA/DD
Status of Monitoring Wells in the Industrial Area at Rocky Flats Plant
October 14, 1992

	WELL NAME	STATE NORTH	STATE EAST	GENERAL AREA	WELL STATUS	WELL CLASS	S. FR	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP BEDROCK
103	P219189	751222	2084010	Plant	ACTIVE	Special Purpose	N	Qc	5941.2	5943.15	12.8	7.1	11.5	11.0
104	P219489	750415	2085651	Plant	ACTIVE	RCRA	N	Qrf	5959.5	5961.15	24.2	18.5	22.9	22.5
105	P219589	750268	2085536	Plant	ACTIVE	RCRA	N	Kclst & Ksclst	5963.8	5965.70	27.0	21.3	25.7	17.2
106	P313489	748913	2083062	Plant	ACTIVE	Special Purpose	N	Qrf	6011.7	6013.58	22.4	16.7	21.1	20.6
107	P313589	748510	2083547	Plant	ACTIVE	Special Purpose	N	Qrf	6008.5	6010.11	13.8	8.1	12.5	11.0
108	P314089	749461	2083653		ACTIVE			Qrf	5996.7	5998.49	11.1	5.4	9.8	9.3
109	P314289	748216	2083280	Plant	ACTIVE	Special Purpose	N	Qrf	6010.1	6011.77	14.8	9.1	13.5	13.0
110	P317989	748891	2084272	OPWL	ACTIVE	Special Purpose	N	Qrf	5990.9	5992.84	8.7	3.0	7.5	6.4
111	P320089	748799	2083280		ACTIVE			Qrf	6009.9	6011.87	20.1	14.4	18.8	18.8
112	P414189	749059	2082986	Plant	ACTIVE	Special Purpose	N	Qrf	6010.6	6012.18	19.8	14.1	18.5	18.0
113	P415889	749125	2080718	Plant	ACTIVE	Special Purpose	N	Qrf	6050.4	6052.60	44.5	38.8	43.2	49.5
114	P415989	749025	2081011	Plant	ACTIVE	Special Purpose	N	Qrf	6044.9	6046.71	28.0	22.3	26.7	34.0
115	P416089	748605	2080720	Plant	ACTIVE	Special Purpose	N	Qrf	6051.7	6053.95	35.4	29.2	34.0	33.5
116	P416189	748606	2081120	Plant	ACTIVE	Special Purpose	N	Qrf	6045.6	6047.95	30.9	25.2	29.7	29.2
117	P416289	748598	2081555	Plant	ACTIVE	Special Purpose	N	Qrf	6038.6	6040.22	24.8	19.1	23.5	23.0
118	P416389	748313	2080631	Plant	ACTIVE	Special Purpose	N	Qrf	6055.4	6057.14	31.4	25.7	30.1	30.0
119	P416489	748210	2081113	Plant	ACTIVE	Special Purpose	N	Qrf	6048.5	6050.15	27.0	21.3	25.7	25.2
120	P416589	748211	2081546	Plant	ACTIVE	Special Purpose	N	Qrf	6041.2	6042.81	32.1	27.0	31.0	30.5
121	P416689	748147	2081941	Plant	ACTIVE	Special Purpose	N	Qrf	6035.0	6036.55	33.8	28.1	32.5	32.0
122	P416789	748206	2082382	Plant	ACTIVE	Special Purpose	N	Qrf	6027.8	6029.27	28.2	22.5	26.9	26.4
123	P416889	748206	2082815	Plant	ACTIVE	Special Purpose	N	Qrf	6017.4	6018.79	21.5	15.9	20.3	20.2
124	P416989	748780	2081034	Buffer West	INACTIVE	Special Purpose	N	Kssit & Kslt	6045.2	6047.55	158.0	151.2	155.6	30.0
125	P418289	748952	2082653		ACTIVE			Qrf	6016.9	6018.20	26.7	9.6	23.5	23.0
126	P419689	748522	2082513	Plant	ACTIVE	Special Purpose	N	Qrf & Kss	6022.4	6023.42	24.8	19.1	23.5	22.0
127	00191	749237	2086244		ACTIVE	CERCLA	Q	Qrf	5968.9	5970.44	27.0	15.0	25.0	24.2
128	01391	749402	2085226		ACTIVE	CERCLA	Q	Qrf	5973.7	5975.30	16.0	6.0	14.0	14.5
129	01491	749430	2085474		ACTIVE	CERCLA	Q	Kss & Kcs	5970.4	5972.03	26.0	14.0	24.0	1.6
130	01791	749504	2086018		ACTIVE	CERCLA	Q	Kslts & Ksclst	5965.8	5967.41	20.0	10.0	18.0	8.0
131	01891	749438	2086023	903, Trench	ACTIVE	CERCLA	Q	Kslts & Kslclst	5971.8	5973.37	32.0	20.0	30.0	12.4
132	02091	749617	2086428		ACTIVE	CERCLA	Q	Ksclst, Kssit, Kslclst	5965.2	5966.65	32.6	15.6	30.6	16.1
133	02191	749708	2086166		ACTIVE	CERCLA	Q	Qrf	5965.8	5967.51	15.0	8.0	13.0	13.5
134	02291	749880	2086139		ACTIVE	CERCLA	Q	Ksclst & Kcss	5936.7	5938.26	18.5	11.5	16.5	8.8
135	02491	749949	2086432		ACTIVE			Kslts, Kssit	5944.5	5946.21	18.8	11.8	16.8	8.5
136	02691	750385	2086043		ACTIVE	CERCLA	Q	Kslts & Kslclst	5934.8	5936.38	18.0	6.0	16.0	1.1

TABLE 4-3
Industrial Area IM/IRA/DD
Status of Monitoring Wells in the Industrial Area at Rocky Flats Plant
October 14, 1992

	WELL NAME	STATE NORTH	STATE EAST	GENERAL AREA	WELL STATUS	WELL CLASS	S. FR	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP BEDROCK
137	06591	749064	2085535	903 Pad, LIP	ACTIVE	CERCLA	Q	Kcslst & Kaltclst	5978.3	5979.78	50.0	33.0	48.0	15.4
138	06691	749068	2085714	903 Pad	ACTIVE	CERCLA	Q	Qrf	5978.3	5979.94	25.1	13.1	23.1	22.0
139	06791	748855	2085646		ACTIVE	CERCLA	Q	Qrf	5978.9	5980.38	23.2	11.2	21.2	21.2
140	06891	749258	2085883	903 Pad	ACTIVE	CERCLA	Q	Qrf	5974.1	5975.62	16.0	6.0	14.0	14.0
141	06991	749168	2085990	903 Pad	ACTIVE	CERCLA	Q	Qrf	5972.9	5974.57	31.0	14.0	29.0	28.6
142	07191	748850	2085908	903 Pad, LIP	ACTIVE	CERCLA	Q	Qrf	5974.8	5976.34	23.1	11.1	21.1	20.0
143	07291	748748	2085766	903 Pad	ACTIVE	CERCLA	Q	Qrf	5977.3	5978.80	22.6	10.6	20.6	20.0
144	07391	748547	2085827	903 Pad	ACTIVE	CERCLA	Q	Qrf & Kclst	5949.1	5950.61	13.4	5.4	11.4	8.1
145	08891	749128	2085866		ACTIVE	CERCLA	Q	Qrf	5976.4	5978.06	27.3	15.3	25.3	23.0
146	09091	748918	2085943	903 Pad	ACTIVE	CERCLA	Q	Qrf	5975.2	5976.79	26.7	14.7	24.7	24.0
147	09691	748572	2086038		ACTIVE	CERCLA	Q	Kaltss & Kclst	5935.6	5937.05	16.0	6.0	14.0	3.1
148	12091	749436	2086009		ACTIVE	CERCLA	Q	Kaltss	5971.6	5973.27	24.0	14.0	22.0	13.2
149	12291	749429	2085441		ACTIVE	CERCLA	Q	Kcss & Kss	5971.0	5972.73	16.1	7.1	14.1	2.0
150	13091	748960	2085992	903 Pad	ACTIVE	CERCLA	Q	Qrf	5973.7	5975.20	23.3	11.3	21.3	19.5
151	13191	749071	2085530		ACTIVE	CERCLA	Q	Kcslst	5978.3	5979.90	27.7	15.7	25.7	15.4
152	13291	749060	2085523		ACTIVE	CERCLA	Q	Qrf	5978.5	5979.97	17.7	5.7	15.7	15.4
153	20591	749405	2086316	NE Trenches	INACTIVE	Special Purpose	N	Qrf	5968.0	5969.61	24.6	4.1	24.1	24.5
154	20691	749411	2086317		INACTIVE	Special Purpose	N	Qrf	5968.1	5969.63	25.0	4.5	24.5	24.5
155	20791	749416	2086318	NE Trenches	INACTIVE	Special Purpose	N	Kcslst & Kscslst	5967.9	5969.49	36.5	29.5	34.5	24.5
156	33491	748080	2084883	IHSS 119.1	ACTIVE	CERCLA	Q	Qc & Kclst	5926.1	5928.59	11.1	6.7	8.7	8.0
157	33691	748112	2084994	IHSS 119.1	ACTIVE	CERCLA	Q	Qc	5927.0	5929.24	10.6	6.2	8.1	7.8
158	33891	747961	2084641	IHSS 119.1	ACTIVE	CERCLA	Q	Qc & Kclst	5927.5	5929.94	11.1	6.7	8.7	8.1
159	34591	748462	2085621	IHSS 119.2	ACTIVE	CERCLA	Q	Qc & Kclst	5952.2	5954.63	11.3	6.9	8.9	8.2
160	34791	748377	2085521	IHSS 119.2	ACTIVE	CERCLA	Q	Qc	5951.4	5953.91	10.4	6.0	8.0	8.0
161	35391	748011	2083907	IHSS 177	ACTIVE	CERCLA	Q	Kclst	5960.7	5963.03	10.5	6.1	8.1	6.0
162	35991	748057	2083756	IHSS 145	ACTIVE	CERCLA	Q	Qc	5973.3	5976.45	16.1	8.7	13.7	12.2
163	36191	748091	2084198	IHSS 103	ACTIVE	CERCLA	Q	Qc	5962.9	5965.17	17.0	9.5	14.6	14.0
164	36391	748042	2084294	IHSS 130	ACTIVE	CERCLA	Q	Qrf	5964.6	5967.01	29.8	17.4	27.4	26.4
165	36691	748027	2084421	IHSS 130	ACTIVE	CERCLA	Q	Qc	5949.8	5951.52	27.8	15.8	25.8	25.0
166	36991	748180	2084177	IHSS 103	ACTIVE	CERCLA	Q	Qrf & Kclst	5969.5	5972.31	10.6	6.6	8.6	8.0
167	37191	748036	2084533	IHSS 130	ACTIVE	CERCLA	Q	Qc	5945.9	5948.29	23.1	11.1	21.1	20.5
168	37591	748580	2084610	Upgradient OU1	ACTIVE	CERCLA	Q	Qrf	5991.4	5993.45	14.6	7.6	12.6	12.0
169	37691	748692	2085217	Upgradient OU1	ACTIVE	CERCLA	Q	Qrf	5984.5	5985.24	18.5	6.5	16.5	16.2
170	37791	748592	2083753	Upgradient OU1	ACTIVE	CERCLA	Q	Qrf	6002.2	6004.18	22.6	10.6	20.6	20.0

TABLE 4-3
Industrial Area IM/IRA/DD
Status of Monitoring Wells in the Industrial Area at Rocky Flats Plant
October 14, 1992

	WELL NAME	STATE NORTH	STATE EAST	GENERAL AREA	WELL STATUS	WELL CLASS	S. FR	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP BEDROCK
171	37891	748075	2084915	IHSS 119.1, 130	ACTIVE	CERCLA	Q	Kcsltst & Ksltst	5925.2	5926.29	55.2	43.2	53.2	4.7
172	37991	748063	2084731	IHSS 119.1, 130	ACTIVE	CERCLA	Q	Kcsltst & Kssltst	5931.5	5933.55	57.2	45.2	55.2	6.9
173	38191	748014	2084765	IHSS 119.1	ACTIVE	CERCLA	Q	Qc	5924.5	5926.40	17.0	10.0	15.0	14.7
174	38291	748032	2084801	IHSS 119.1	ACTIVE	CERCLA	Q	Qc	5924.5	5926.71	10.7	6.7	8.7	8.4
175	39691	748357	2083634	Upgradient OU1	ACTIVE	CERCLA	Q	Qrf & Kclst	6006.3	6008.37	11.0	7.0	9.0	8.0
176	75992	750290	2086628	West Spray Field	ACTIVE		Q	Qc	5897.1	5899.10	12.0	5.0	10.0	10.0
177	76192	750660	2086122	West Spray Field	ACTIVE		Q	Qrf	5960.0	5963.00	8.0	4.0	6.0	6.0
178	76292	750769	2085681	West Spray Field	ACTIVE		Q	Kcss	5957.0	5959.30	21.2	9.2	19.2	8.5
179	77492	751246	2083508	PA	ACTIVE			Qrf	5942.0	5944.50	24.1	12.1	22.1	22.5
180	05093	750804	2085231	PA	ACTIVE			Qrf	5963.3	5965.54	12.5	3.5	10.5	9.7
181	05293	750198	2084490	PA	ACTIVE			Qrf	5980.7	5983.11	9.7	2.7	7.7	6.6
182	22093	748623	2085973		ACTIVE			Kclst,Kcslt,Ksltss	5945.0	5947.43	66.3	48.0	63.0	8.8
183	22393	749564	2086121		ACTIVE			Kcslst & Kclst	5969.3	5972.14	121.3	108.2	118.0	19.7

STATE NORTH = state plane coordinates, Northing.
STATE EAST = state plane coordinates, Easting.

OPWL = original process waste line
PA = Protected Area

WELL CLASSIFICATION:
RCRA-C = RCRA characterization monitoring wells- information used to determine the rate and extent of migration of hazardous waste
RCRA-S = monitoring wells used for RCRA statistical comparisons [40 CFR 265.93(b) and 265.94(a)(2)(II)]
CERCLA = monitoring wells specified in RFI/RI work plans. Industrial Area IM/IRA characterization wells will convert to "Plant Protection" wells.

S. FR. = Sampling frequency:
Q = quarterly N = not sampled

SURFACE ELEV. = elevation of land surface at well head, in feet above mean sea level.
TOP OF CASING = elevation of top of well casing, in feet above mean sea level.
TD = total depth of casing, measured in feet below ground surface.
TOP SCRN = top of screened interval, measured in feet below ground surface.
BOT SCRN = bottom of screened interval, measured in feet below ground surface.
TOP BEDROCK = top of bedrock, measured in feet below ground surface.

COMPLETION UNIT/LITHOLOGY = rock type in which well is screened:

- Kss = Cretaceous sandstone
- Kclst = Cretaceous claystone
- Kcslt = Cretaceous clayey siltstone
- Kcss = Cretaceous clayey sandstone
- Kscist = Cretaceous sandy claystone
- Kslt = Cretaceous siltstone
- Kslticlst = Cretaceous silty claystone
- Ksltss = Cretaceous silty sandstone
- Kssit = Cretaceous sandy siltstone
- Qa = Quaternary alluvium
- Qc = Quaternary colluvium
- Qrf = Quaternary Rocky Flats Alluvium

4.3.3 Analytes

Every monitoring well in the sampling network is subject to the same suite of analytes. The analytical constituents have been selected based on EPA and CDH requirements, technical needs, and the history of operations at RFP. The practice of sampling all wells for the same analytical suite has been reviewed (EG&G 1993a) and recommendations have been made to consider reducing wells to location-specific analytical suites, where appropriate.

The RFP standard analytical suite for groundwater samples consists of the following analytes and analyte groups:

- TCL VOCs;
- water quality parameters;
- nitrate/nitrite as nitrogen;
- gross alpha, gross beta, uranium, cesium, radium, and strontium (dissolved);
- CLP TAL standard and additional metals (dissolved);
- tritium, plutonium, americium (total);
- cyanide; and
- orthophosphate.

This standard suite is itemized in more detail in Table 4-4. SVOCs are analyzed only during the first quarter after installation of a new well.

4.3.4 Sampling Procedures

The SOP for groundwater sampling (EG&G 1991g) describes the procedures required for the collection of all groundwater samples. The procedures are designed to avoid contamination of groundwater samples by foreign materials, ensure representative

TABLE 4-4
Industrial Area IM/IRA/DD
Chemical Constituents Monitored in Groundwater at Rocky Flats Plant

Metals	Organics[a]	Radionuclides[b]
Cesium (Cs)	Target Compound List-Volatiles	Gross Alpha
Lithium (Li)[c]	Chloromethane (CH_3Cl)	Gross Beta
Molybdenum (Mo)	Bromomethane (CH_3Br)	Uranium-233, -234,-235, and -238
Strontium (Sr)	Vinyl Chloride (C_2H_3Cl)	Americium-241
Tin (Sn)[d]	Chloroethane (C_2H_5Cl)	Plutonium-239, -240
	Methylene Chloride (CH_2Cl)	Strontium-89, -90[e]
Target Analyte List	Acetone	Cesium-137
Aluminum (Al)	Carbon Disulfide	Tritium (H-3)
Antimony (Sb)	1,1-Dichloroethane (1,1-DCA)	Radium-226, -228[f]
Arsenic (As)	1,1-Dichloroethene (1,1-DCE)	
Barium (Ba)	trans 1,2-Dichloroethene	**Indicators**
Beryllium (Be)	1,2-Dichloroethene (total) (total 1,2-DCE)	Total Dissolved Solids (TDS)
Cadmium (Cd)	Chloroform ($CHCl_3$)	pH[d]
Calcium (Ca)	1,2-Dichloroethane (1,2-DCA)	
Chromium (Cr)	2-Butanone (MEK)	**Field Parameters**
Cobalt (Co)	1,1,1-Trichloroethane (1,1,1-TCA)	pH
Iron (Fe)	Carbon Tetrachloride (CCl_4)	Specific Conductance
Lead (Pb)	Vinyl Acetate	Temperature
Magnesium (Mg)	Bromodichloromethane	Dissolved Oxygen
Manganese (Mn)	1,1,2,2,-Tetrachloroethane	Alkalinity
Mercury (Hg)	1,2-Dichloropropane (1,2-DCP)	
Nickel (Ni)	trans-1,3-Dichloropropene	**Anions**
Potassium (K)	Trichloroethene (TCE)	Carbonate (CO_3)
Selenium (Se)	Dibromochloromethane	Bicarbonate (HCO_3)
Silver (Ag)	1,1,2-Trichloroethane	Chloride (Cl)
Sodium (Na)	Benzene	Sulfate (SO_4)
Thallium (Tl)	cis-1,3-Dichloropropene	Nitrate/Nitrite (NO_2/NO_3 as N)
Vanadium (V)	Bromoform (CBr_4)	Cyanide (CN)[g]
Zinc (Zn)	2-Hexanone	Fluoride (F)
	4-Methyl-2-pentanone	Orthophosphates (PO_4)
	Tetrachlorethene (PCE)	
	Toluene (C_7H_8)	
	Chlorobenzene (C_6H_5Cl)	
	Ethyl Benzene	
	Styrene	
	Total Xylenes	

a. Not analyzed in background samples in 1989.
b. Dissolved radionuclides replaces total radionuclides (except tritium) beginning with the third quarter 1987; however, total Pu and Am were collected starting in third quarter 1988.
c. Before 1989, lithium was only analyzed during fourth quarter 1987 and first quarter 1988.
d. Not analyzed before 1989.
e. Strontium-89, -90 was not analyzed during first quarter 1988.
f. Not analyzed before 1989, and only analyzed if gross alpha exceeds 5 pCi/l.
g. Cyanide was not analyzed during fourth quarter 1987.

Total suspended solids and phosphate were analyzed in 1986 only; orthophosphates were analyzed in 1990 and in 1991.
Chromium (VI) was analyzed during fourth quarter 1987 only.

samples, minimize the potential for cross-contamination of samples or wells, and ensure reproducibility of results. Limited sample volumes are sometimes available because of the low yield of the water-bearing formations at RFP. For this reason, the analyses are prioritized and samples for each analytical method are collected in consistently the same order.

4.4 PATHWAY ANALYSIS

The following sections evaluate the potential for the upper and lower hydrostratigraphic units to act as pathways for contaminant transport.

4.4.1 Upper Hydrostratigraphic Unit as a Pathway

The upper hydrostratigraphic unit may be a pathway for transport of contaminants released at ground surface or in the shallow subsurface. Chemical constituents from surficial spills may be leached through the permeable surficial soils to the water table, by infiltrating precipitation. Upon reaching the water table, groundwater flows in the directions discussed in Section 4.2.1. Water from the upper hydrostratigraphic unit may evaporate or seep out to become surface water at the wetland/seep locations indicated on Plates 4-1 and 4-2. A lesser amount of groundwater also infiltrates into the lower hydrostratigraphic unit.

4.4.2 Lower Hydrostratigraphic Unit as a Pathway

Several factors must be considered in the analysis of the lower hydrostratigraphic unit as a potential contaminant pathway. The low hydraulic conductivity and high adsorptive properties of the Arapahoe/Laramie Formation claystone and siltstone may preclude them from consideration as a significant contaminant pathway. However, the sandstone units

have higher permeabilities and documented contamination (EG&G 1993k). The OU2 RFI/RIs concluded that the bedrock pathways are incomplete. However, building footing drains that are completed in bedrock (not a concern in the vicinity of OU2) may provide channels for UBC through bedrock in the Industrial Area. Monitoring recommendations for building sumps and footing drains are made in Section 7.7.

The bedrock was investigated as a potential exposure pathway during OU2 RI/RFI activities. The study indicated that the pathway in the lower hydrostratigraphic unit was considered to be incomplete for the OU2 area. However, chlorinated hydrocarbons such as carbon tetrachloride, tetrachloroethene (PCE), and trichloroethene (TCE) were detected in both the Laramie Formation sandstone units and the upper hydrostratigraphic unit (EG&G 1993j). Potential sources of contamination to the lower hydrostratigraphic unit were believed to be limited to secondary contaminant plumes in the upper hydrostratigraphic unit. Two scenarios for contaminant migration to the lower hydrostratigraphic unit were investigated: (1) lateral migration of contaminants from the upper hydrostratigraphic unit to discharge points beneath the colluvium along Woman Creek with recharge from the colluvium to subcropping Laramie Formation sandstone units, and (2) vertical migration of contamination from the upper hydrostratigraphic unit to the sandstones in the lower hydrostratigraphic unit, where Laramie Formation sandstones are in vertical proximity to the upper aquifer. Contamination of the bedrock was believed to be associated with scenario 1, which is an upper aquifer exposure pathway. The bedrock exposure pathway was considered to be incomplete in the vicinity of OU2.

The lower hydrostratigraphic unit and discontinuous nature of the Laramie Formation sandstones suggest that there is no viable migration pathway for contaminants to reach ground surface, although data on the spatial distribution of the sandstones are not complete. The thickness and low vertical hydraulic conductivity of the Laramie Formation will likely impede the downward movement of chemical constituents and

Formation will likely impede the downward movement of chemical constituents and prevent contamination of the Laramie-Fox Hills aquifer. The lower hydrostratigraphic unit is therefore not considered a potential contaminant pathway.

4.5 SUMMARY OF EXISTING DATA

Groundwater sampling results are reported under the respective sampling programs, and the information is entered into the Rocky Flats Environmental Database System (RFEDS). The four primary reports that contain RFP groundwater data are (1) the *Rocky Flats Plant Site Environmental Report, January through December 1992* (EG&G 1993c), which is required by DOE and has been published for approximately 20 years, (2) the *Annual RCRA Groundwater Monitoring Report for Regulated Units at Rocky Flats Plant* (EG&G 1993l), (3) the *Final Background Geochemical Characterization Report* (EG&G 1992d), and (4) the recent *Well Evaluation Report* (EG&G 1993a).

The Annual RCRA Groundwater Reports only address the RCRA Interim Status regulated units that require groundwater monitoring. These are the Solar Ponds (OU4), the Present Landfill (OU7), and West Spray Field (OU11). Various other reports are produced for RCRA and CERCLA investigations and remedial activities.

The *Well Evaluation Report* (EG&G 1993a) examined groundwater geochemical data to determine the site-wide extent, magnitude, spatial distribution, and temporal variation of contaminant distributions in groundwater at RFP. Concentration contour maps for selected analytes were constructed using data from the spring and fall of 1990 and 1992. Monitoring wells in active RCRA, CERCLA, and background programs were analyzed during those sampling rounds. The eastern portion of the Industrial Area was covered in detail, but relatively few groundwater samples were collected for analysis in the west and central portions of the Industrial Area.

The contour maps in the *Well Evaluation Report* (EG&G 1993a) displayed the concentrations of lithium, selenium, gross alpha, gross beta, uranium-233, uranium-234, plutonium-239, plutonium-240, americium-241, TCE, PCE, "total" VOCs, total dissolved solids (TDS), nitrate plus nitrite, and sulfate. Separate concentration contour maps were prepared for wells installed in unconsolidated surficial deposits and in shallow bedrock. For this purpose, shallow bedrock wells were defined as wells in which the top of the screened interval is within the upper 40 feet of bedrock. This interval of bedrock includes the weathered portion, where most bedrock contamination is thought to occur (EG&G 1993a).

The distribution of contaminants was summarized as follows:

> Groundwater contamination is most consistently detected within the OUs.... Wells not related to OUs and located in the buffer zone in general do not yield waters with any notable contamination. Exceptions do exist, however... .
>
> Wells located in the vicinity of the Solar Evaporation Ponds (OU4) consistently exhibit the highest concentrations or activities in groundwater of most of the selected analytes. These include metals (lithium), radionuclides (gross alpha, gross beta, and uranium-233, 234), and inorganic parameters (TDS and nitrate plus nitrite). Elevated concentrations of VOCs are also found in this area. Gross alpha and TCE are present at elevated levels immediately upgradient and downgradient of the ponds.
>
> Wells in the area of the 903 Pad, Mound, East Trenches, and East Spray Field (OU2) display the highest activities of plutonium-239, 240 and americium-241 (903 pad) and the highest concentrations of VOCs (TCE, PCE). Inorganic parameters, most notably nitrate plus nitrite, are also present at OU2 in elevated concentrations. Groundwater from the area around the 881 Hillside (OU1) shows high concentrations of VOCs and metals, including the highest selenium concentrations.
>
> Groundwater in the vicinity of the Present Landfill (OU7) is characterized by elevated concentrations of metals, VOCs, and inorganic parameters, and occasionally higher activities of some radionuclides (gross alpha, gross beta, uranium-233, 244, plutonium-239, 240 and americium-241).

The Walnut Creek drainage (OU6), including South Walnut Creek, North Walnut Creek, No Name Gulch, and the associated ponds, exhibits elevated levels of inorganic parameters, metals, and some radionuclides (gross alpha, gross beta, plutonium-239, 240 and americium-241) in groundwater from wells along its length. The concentrations of these analytes decrease between the confluence of the three tributaries of Walnut Creek and the wells along Walnut Creek just west of Indiana Street.

The distribution of contaminants in groundwater from alluvial wells was compared with that from shallow (less than 40 feet) bedrock wells. The distributions were correlative, and "most well-defined groundwater contaminant plumes exist in both the unconsolidated surficial deposits and in bedrock" (EG&G 1993a). Groundwater concentrations of lithium, TCE, TDS, and nitrate plus nitrite were often higher in bedrock groundwater than in alluvial groundwater. Higher PCE and TCE in bedrock groundwater could indicate the presence of dense nonaqueous-phase liquid (DNAPL) in the bedrock. However, DNAPLs have never been detected as free liquids in groundwater at any location at RFP (EG&G 1993a).

The *Well Evaluation Report* did not incorporate all of the data for wells in the Industrial Area. Some of the piezometers are not sampled regularly, and other groundwater data were screened from consideration. The fact that high concentrations of analytes are not observed in the western and west-central Industrial Area may be attributable to lack of data, rather than lack of chemical constituents.

To better characterize groundwater chemistry in the Industrial Area, RFEDS data for 36 of the 54 piezometers installed in 1989 were examined as part of this IM/IRA. The piezometers had been installed for the purpose of collecting groundwater level measurements to determine hydraulic gradients at RFP. Groundwater samples had been collected from piezometers under the Environmental Monitoring and Analysis Division (EMAD), GPMP, OU9 RFI/RI, and surface water programs in 1989, 1990, and 1991. From this data set, the chemical constituents detected during the most recent sampling

From this data set, the chemical constituents detected during the most recent sampling event from each well are tabulated in Appendix 4.2, 4.3, and 4.4. Data were available for 17 piezometers in the Protected Area and three piezometers in the western part of the Industrial Area. Organic compounds were detected in Wells P115489 to the west and P320089 to the south. Wells in the vicinity of the Solar Ponds also indicated elevated levels of chlorinated and nonchlorinated VOCs. Groundwater samples from wells near the Solar Ponds also produced elevated radionuclide counts, as summarized in Appendix 4.4.

Thirty seven wells and piezometers were sampled for Industrial Area IM/IRA characterization in November and December 1993. Those samples are still being analyzed, and the results are being validated. Initial (unvalidated) VOC results from 20 of the 37 wells and piezometers, along with other fourth quarter groundwater samples, are presented in Table 4-5 and Figure 4-4. Organic compounds, such as vinyl chloride (C_2H_3Cl), 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethene (1,2-DCE), 1,2-dichloroethane (1,2-DCA), 1,1,1-trichloroethane, carbon tetrachloride (CCl_4), TCE, 1,1,2-trichloroethane, and PCE were detected in 12 of the 20 piezometers for which data were received. Several of the 12 piezometers sampled contained only small amounts of relatively few VOCs, such as P416389 (0.5 micrograms per liter [μg/L] naphthalene) and P416589 (0.7 μg/L PCE). Eight of the 20 piezometers (P114989, P115089, P314089, P415989, P416089, P416189, P416489, and P416989) had no VOCs detected.

Existing data regarding UBC and footing drain sampling are also relevant to groundwater in the Industrial Area. UBC was identified and documented at 31 buildings in the Industrial Area, according to the *HRR* (EG&G 1992f). Soil and/or groundwater beneath the identified buildings may have become contaminated as result of activities within the buildings. The results from aperiodic sampling of building sumps and foundation drains also indicate elevated metals, organic compounds, and radionuclides in water from

TABLE 4–5
Industrial Area IM/IRA/DD
Groundwater Analytical Results from Industrial Area Monitoring Wells, 4th Quarter 1993

Well Number Date Sampled Units	05093 18–Oct–93 (µg/L)	05193 18–Oct–93 (µg/L)	11092 11–Nov–93 (µg/L)	22293 05–Nov–93 (µg/L)	2286 13–Oct–93 (µg/L)	2386 29–Oct–93 (µg/L)	2586 22–Oct–93 (µg/L)	2786 25–Oct–93 (µg/L)
1,1,1–TRICHLOROETHANE	<0.1	<0.1	<0.1	<0.1	<5	<5	<5	<5
1,1,2–TRICHLOROETHANE	<0.6	<0.6	<0.6	<0.6	<5	<5	<5	<5
1,1,2–TRICHLORO–1,2,2–TRIFLUOROETHANE	NR	NR	NR	NR	NR	NR	NR	NR
1,1–DICHLOROETHANE	<0.1	<0.1	<0.1	<0.1	<5	<5	<5	<5
1,1–DICHLOROETHENE	<0.2	<0.2	<0.2	<0.2	<5	<5	<5	<5
1,2,3–TRICHLOROBENZENE	<0.2	<0.2	<0.2	<0.2	NR	NR	NR	NR
1,2,4–TRICHLOROBENZENE	<0.3	<0.3	<0.3	<0.3	NR	NR	NR	NR
1,2–DICHLOROBENZENE	<0.1	<0.1	<0.1	<0.1	NR	NR	NR	NR
1,2–DICHLOROETHANE	<0.4	<0.4	<0.4	<0.4	<5	<5	<5	<5
1,2–DICHLOROETHENE	NR	NR	NR	NR	25.00	<5	<5	<5
1,2–DICHLOROPROPANE	<0.1	<0.1	<0.1	<0.1	<5	<5	<5	<5
ACETONE	NR	NR	NR	NR	<10	<10	<10	<10
AZULENE	NR	NR	NR	NR	NR	NR	NR	NR
BENZENE	0.20	<0.1	<0.1	<0.1	<5	<5	<5	<5
BIS(2–ETHYLHEXYL)PHTHALATE	NR	NR	NR	NR	NR	NR	NR	NR
BROMACIL	NR	NR	NR	NR	NR	NR	NR	NR
CARBON TETRACHLORIDE	<0.2	<0.2	<0.2	<0.2	210.00	<5	<5	<5
CHLOROETHANE	<0.4	<0.4	<0.4	<0.4	<10	<10	<10	<10
CHLOROFORM	0.60	0.30	<0.1	<0.1	61.00	<5	<5	<5
CHLOROTRIFLUOROETHENE	NR	NR	NR	NR	NR	NR	NR	NR
cis–1,2–DICHLOROETHENE	0.50	<0.2	<0.2	<0.2	NR	NR	NR	NR
1,2–DICHLORO–1,1,2–T ETHANE	NR	NR	NR	NR	NR	NR	NR	NR
METHYLENE CHLORIDE	1.00	1.00	<0.1	<0.1	<5	<5	9.00	<5
NAPHTHALENE	<0.2	<0.2	<0.2	<0.2	NR	NR	NR	NR
TETRACHLOROETHENE	0.50	14.00	<0.1	<0.1	<5	<5	<5	<5
TIC	1.20	NR	NR	NR	NR	NR	NR	NR
TOLUENE	0.30	<0.1	<0.1	<0.1	<5	<5	<5	<5
trans–1,2–DICHLOROETHENE	<0.2	<0.2	<0.2	<0.2	NR	NR	NR	NR
TRICHLOROETHENE	1.00	16.00	<0.1	<0.1	220.00	<5	<5	<5
VINYL CHLORIDE	<0.2	<0.2	<0.2	<0.2	<10	<10	<10	<10

NR = Not Reported
< = The compound was analyzed but was not detected. The associated value is the sample quantification limit.
TIC = tentatively identified compound
µg/L = micrograms per liter

TABLE 4-5
Industrial Area IM/IRA/DD
Groundwater Analytical Results from Industrial Area Monitoring Wells, 4th Quarter 1993

Well Number	3086	37591	37791	37891	37991	3987	5187	5287
Date Sampled	20-Oct-93	23-Nov-93	04-Nov-93	23-Nov-93	23-Nov-93	26-Oct-93	04-Nov-93	03-Nov-93
Units	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
1,1,1-TRICHLOROETHANE	<5	<0.5	<0.1	<0.5	<0.5	<5	<5	<5
1,1,2-TRICHLOROETHANE	<5	<0.5	<0.6	<0.5	<0.5	<5	<5	<5
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	NR	NR	NR	NR	NR	NR	NR	NR
1,1-DICHLOROETHANE	<5	<0.5	<0.1	<0.5	<0.5	<5	<5	<5
1,1-DICHLOROETHENE	<5	<0.5	<0.2	<0.5	<0.5	<5	<5	<5
1,2,3-TRICHLOROBENZENE	NR	<0.5	<0.2	<0.5	<0.5	NR	NR	NR
1,2,4-TRICHLOROBENZENE	NR	<0.5	<0.3	<0.5	<0.5	NR	NR	NR
1,2-DICHLOROBENZENE	NR	<0.5	<0.1	<0.5	<0.5	NR	NR	NR
1,2-DICHLOROETHANE	<5	<0.5	<0.4	<0.5	<0.5	<5	<5	<5
1,2-DICHLOROETHENE	<5	NR	NR	NR	NR	<5	<5	<5
1,2-DICHLOROPROPANE	<5	<0.5	<0.1	<0.5	<0.5	<5	<5	<5
ACETONE	<10	NR	NR	NR	NR	5.00	<10	<10
AZULENE	NR	NR	NR	NR	NR	NR	NR	NR
BENZENE	<5	<0.5	<0.1	<0.5	<0.5	<5	<5	<5
BIS(2-ETHYLHEXYL)PHTHALATE	NR	NR	NR	NR	NR	NR	NR	NR
BROMACIL	NR	NR	NR	NR	NR	NR	NR	NR
CARBON_TETRACHLORIDE	<5	<0.5	<0.2	<0.5	<0.5	<5	<5	<5
CHLOROETHANE	<10	<0.5	<0.4	<0.5	<0.5	<10	<10	<10
CHLOROFORM	<5	<0.5	<0.1	0.90	<0.5	<5	<5	<5
CHLOROTRIFLUOROETHENE	NR	NR	NR	NR	NR	NR	NR	NR
cis-1,2-DICHLOROETHENE	NR	<0.5	<0.2	<0.5	<0.5	NR	NR	NR
1,2-DICHLORO-1,1,2-T_ETHANE	NR	NR	NR	NR	NR	NR	NR	NR
METHYLENE_CHLORIDE	8.00	<0.5	<0.1	<0.5	<0.5	<5	<5	<5
NAPHTHALENE	NR	<0.5	<0.2	<0.5	<0.5	NR	NR	NR
TETRACHLOROETHENE	<5	<0.5	<0.1	<0.5	<0.5	<5	3.00	<5
TIC	NR	NR	NR	0.60	NR	NR	NR	NR
TOLUENE	<5	<0.5	<0.1	<0.5	<0.5	<5	<5	<5
trans-1,2-DICHLOROETHENE	NR	<0.5	<0.2	<0.5	<0.5	NR	NR	NR
TRICHLOROETHENE	<5	<0.5	<0.1	<0.5	0.50	<5	<5	<5
VINYL_CHLORIDE	<10	<0.5	<0.2	<0.5	<0.5	<10	<10	<10

NR = Not Reported
< = The compound was analyzed but was not detected. The associated value is the sample quantification limit.
TIC = tentatively identified compound
µg/L = micrograms per liter

TABLE 4-5
Industrial Area IM/IRA/DD
Groundwater Analytical Results from Industrial Area Monitoring Wells, 4th Quarter 1993

Well Number	5687	76292	77492	B208089	B208189	P114689	P114789	P114889
Date Sampled	15-Oct-93	29-Oct-93	28-Oct-93	26-Oct-93	26-Oct-93	23-Nov-93	22-Nov-93	22-Nov-93
Units	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
1,1,1-TRICHLOROETHANE	<5	<5	<5	<5	<5	72.00	4.00	<0.5
1,1,2-TRICHLOROETHANE	<5	<5	<5	<5	<5	1.00	<0.5	<0.5
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	45.00	NR	NR	NR	NR	NR	0.70	NR
1,1-DICHLOROETHANE	10.00	<5	<5	<5	<5	37.00	3.00	3.00
1,1-DICHLOROETHENE	6.00	<5	<5	<5	<5	180.00	7.00	0.50
1,2,3-TRICHLOROBENZENE	NR	NR	NR	NR	NR	15.00	0.60	<0.5
1,2,4-TRICHLOROBENZENE	NR	<10	<10	NR	NR	50.00	1.00	<0.5
1,2-DICHLOROBENZENE	NR	<10	<10	NR	NR	0.50	<0.5	<0.5
1,2-DICHLOROETHANE	<5	<5	<5	<5	<5	8.00	<0.5	<0.5
1,2-DICHLOROETHENE	13.00	<5	<5	<5	<5	NR	NR	NR
1,2-DICHLOROPROPANE	<5	<5	<5	<5	<5	<0.5	<0.5	<0.5
ACETONE	<10	<10	<10	<10	<10	NR	NR	NR
AZULENE	NR	NR	NR	NR	NR	NR	NR	NR
BENZENE	<5	<5	<5	<5	<5	<0.5	<0.5	<0.5
BIS(2-ETHYLHEXYL)PHTHALATE	NR	3.00	<10	NR	NR	NR	NR	NR
BROMACIL	NR	31.00	NR	NR	NR	NR	NR	NR
CARBON_TETRACHLORIDE	<5	<5	2.00	<5	<5	340.00	<0.5	<0.5
CHLOROETHANE	<10	<10	<10	<10	<10	<0.5	<0.5	<0.5
CHLOROFORM	5.00	<5	<5	<5	<5	<0.5	1.00	<0.5
CHLOROTRIFLUOROETHENE	NR	NR	NR	NR	NR	6.00	NR	NR
cis-1,2-DICHLOROETHENE	NR	NR	NR	NR	NR	24.00	12.00	88.00
1,2-DICHLORO-1,1,2-T_ETHANE	16.00	NR	NR	NR	NR	NR	NR	NR
METHYLENE_CHLORIDE	<5	<5	<5	<5	<5	0.80	<0.5	<0.5
NAPHTHALENE	NR	<10	<10	NR	NR	0.60	<0.5	<0.5
TETRACHLOROETHENE	3.00	<5	<5	<5	<5	76.00	150.00	78.00
TIC	NR	21.00	NR	NR	NR	2.00	NR	NR
TOLUENE	<5	<5	<5	<5	<5	<0.5	<0.5	<0.5
trans-1,2-DICHLOROETHENE	NR	NR	NR	NR	NR	<0.5	<0.5	<0.5
TRICHLOROETHENE	61.00	<5	<5	<5	<5	39.00	4.00	42.00
VINYL_CHLORIDE	<10	<10	<10	<10	<10	2.00	0.70	<0.5

NR = Not Reported
< = The compound was analyzed but was not detected. The associated value is the sample quantification limit.
TIC = tentatively identified compound
µg/L = micrograms per liter

TABLE 4-5
Industrial Area IM/IRA/DD
Groundwater Analytical Results from Industrial Area Monitoring Wells, 4th Quarter 1993

Well Number	P114989	P115089	P115589	P115689	P207389	P207589	P207689	P207789
Date Sampled	23-Nov-93	21-Nov-93	22-Nov-93	22-Nov-93	12-Oct-93	13-Oct-93	18-Oct-93	14-Oct-93
Units	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
1,1,1-TRICHLOROETHANE	<0.5	<0.5	250.00	7.00	<5	<5	<5	<5
1,1,2-TRICHLOROETHANE	<0.5	<0.5	7.00	1.00	<5	<5	<5	<5
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	NR	NR	NR	NR	NR	NR	NR	NR
1,1-DICHLOROETHANE	<0.5	<0.5	770.00	1.00	<5	<5	<5	<5
1,1-DICHLOROETHENE	<0.5	<0.5	1100.00	27.00	<5	<5	<5	<5
1,2,3-TRICHLOROBENZENE	<0.5	<0.5	2.00	<0.5	NR	NR	NR	NR
1,2,4-TRICHLOROBENZENE	<0.5	<0.5	4.00	<0.5	NR	NR	NR	NR
1,2-DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	NR	NR	NR	NR
1,2-DICHLOROETHANE	<0.5	<0.5	58.00	0.80	<5	<5	<5	<5
1,2-DICHLOROETHENE	NR	NR	NR	NR	<5	<5	<5	<5
1,2-DICHLOROPROPANE	<0.5	<0.5	3.00	<0.5	<5	<5	<5	<5
ACETONE	NR	NR	NR	NR	<10	<10	<10	<10
AZULENE	NR	NR	NR	NR	NR	NR	NR	6.60
BENZENE	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5
BIS(2-ETHYLHEXYL)PHTHALATE	NR	NR	NR	NR	NR	NR	NR	NR
BROMACIL	NR	NR	NR	NR	NR	NR	NR	NR
CARBON_TETRACHLORIDE	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5
CHLOROETHANE	<0.5	<0.5	2.00	<0.5	<10	<10	<10	<10
CHLOROFORM	<0.5	<0.5	3.00	<0.5	<5	<5	<5	<5
CHLOROTRIFLUOROETHENE	NR	NR	NR	NR	NR	NR	NR	NR
cis-1,2-DICHLOROETHENE	<0.5	<0.5	280.00	80.00	NR	NR	NR	NR
1,2-DICHLORO-1,1,2-T_ETHANE	NR	NR	10.00	NR	NR	NR	NR	NR
METHYLENE_CHLORIDE	<0.5	<0.5	5.00	<0.5	<5	<5	<5	1.00
NAPHTHALENE	<0.5	<0.5	<0.5	<0.5	NR	NR	NR	22.12
TETRACHLOROETHENE	<0.5	<0.5	430.00	7.00	<5	<5	<5	<5
TIC	NR	NR	20.00	NR	NR	NR	NR	NR
TOLUENE	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5
trans-1,2-DICHLOROETHENE	<0.5	<0.5	2.00	<0.5	NR	NR	NR	NR
TRICHLOROETHENE	<0.5	<0.5	140.00	18.00	<5	<5	<5	<5
VINYL_CHLORIDE	<0.5	<0.5	31.00	16.00	<10	<10	<10	<10

NR = Not Reported
< = The compound was analyzed but was not detected. The associated value is the sample quantification limit.
TIC = tentatively identified compound
µg/L = micrograms per liter

TABLE 4–5
Industrial Area IM/IRA/DD
Groundwater Analytical Results from Industrial Area Monitoring Wells, 4th Quarter 1993

Well Number Date Sampled Units	P207889 13–Oct–93 (µg/L)	P207989 14–Oct–93 (µg/L)	P208889 25–Oct–93 (µg/L)	P208989 22–Oct–93 (µg/L)	P209089 21–Oct–93 (µg/L)	P209389 19–Oct–93 (µg/L)	P209489 15–Oct–93 (µg/L)	P209589 19–Oct–93 (µg/L)
1,1,1–TRICHLOROETHANE	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2–TRICHLOROETHANE	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2–TRICHLORO–1,2,2–TRIFLUOROETHANE	NR	NR	NR	NR	NR	NR	NR	NR
1,1–DICHLOROETHANE	<5	<5	<5	<5	<5	<5	<5	<5
1,1–DICHLOROETHENE	<5	<5	<5	<5	<5	49.00	<5	<5
1,2,3–TRICHLOROBENZENE	NR	NR	NR	NR	NR	NR	NR	NR
1,2,4–TRICHLOROBENZENE	NR	NR	NR	NR	NR	NR	NR	NR
1,2–DICHLOROBENZENE	NR	NR	NR	NR	NR	NR	NR	NR
1,2–DICHLOROETHANE	<5	<5	<5	<5	<5	<5	<5	<5
1,2–DICHLOROETHENE	<5	<5	<5	<5	<5	<5	11.00	<5
1,2–DICHLOROPROPANE	<5	<5	<5	<5	<5	<5	<5	<5
ACETONE	<10	<10	8.00	<10	<10	<10	<10	<10
AZULENE	NR	NR	NR	NR	NR	NR	NR	NR
BENZENE	<5	<5	<5	<5	<5	<5	<5	<5
BIS(2–ETHYLHEXYL)PHTHALATE	NR	NR	NR	NR	NR	NR	NR	NR
BROMACIL	NR	NR	NR	NR	NR	NR	NR	NR
CARBON_TETRACHLORIDE	<5	<5	<5	<5	<5	17.00	46.00	<5
CHLOROETHANE	<10	<10	<10	<10	<10	<10	<10	<10
CHLOROFORM	<5	<5	<5	<5	<5	9.00	21.00	<5
CHLOROTRIFLUOROETHENE	NR	NR	NR	NR	NR	NR	NR	NR
cis–1,2–DICHLOROETHENE	NR	NR	NR	NR	NR	NR	NR	NR
1,2–DICHLORO–1,1,2–T_ETHANE	NR	NR	NR	NR	NR	NR	8.10	NR
METHYLENE_CHLORIDE	<5	<5	<5	4.00	<5	<5	<5	<5
NAPHTHALENE	NR	NR	NR	NR	NR	NR	NR	NR
TETRACHLOROETHENE	<5	<5	<5	1.00	<5	<5	4.00	<5
TIC	NR	NR	NR	NR	NR	NR	NR	NR
TOLUENE	<5	<5	<5	<5	<5	<5	<5	<5
trans–1,2–DICHLOROETHENE	NR	NR	NR	NR	NR	NR	NR	NR
TRICHLOROETHENE	<5	<5	<5	<5	<5	<5	70.00	<5
VINYL_CHLORIDE	<10	<10	<10	<10	<10	<10	<10	<10

NR = Not Reported
< = The compound was analyzed but was not detected. The associated value is the sample quantification limit.
TIC = tentatively identified compound
µg/L = micrograms per liter

TABLE 4-5
Industrial Area IM/IRA/DD
Groundwater Analytical Results from Industrial Area Monitoring Wells, 4th Quarter 1993

Well Number Date Sampled Units	P209689 12-Oct-93 (µg/L)	P209789 15-Oct-93 (µg/L)	P209889 21-Oct-93 (µg/L)	P210089 20-Oct-93 (µg/L)	P210189 22-Oct-93 (µg/L)	P215789 23-Nov-93 (µg/L)	P314089 23-Nov-93 (µg/L)	P415989 21-Nov-93 (µg/L)
1,1,1-TRICHLOROETHANE	<5	<5	<5	<5	72.00	NR	<0.5	<0.5
1,1,2-TRICHLOROETHANE	<5	<5	<5	<5	<200	<12	<0.5	<0.5
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	NR	NR	NR	NR	NR	NR	NR	NR
1,1-DICHLOROETHANE	<5	<5	<5	<5	<200	<12	<0.5	<0.5
1,1-DICHLOROETHENE	<5	<5	<5	<5	<200	96.00	<0.5	<0.5
1,2,3-TRICHLOROBENZENE	NR	NR	NR	NR	NR	15.00	<0.5	<0.5
1,2,4-TRICHLOROBENZENE	NR	NR	NR	NR	NR	<12	<0.5	<0.5
1,2-DICHLOROBENZENE	NR	NR	NR	NR	NR	<12	<0.5	<0.5
1,2-DICHLOROETHANE	<5	<5	<5	<5	<200	<12	<0.5	<0.5
1,2-DICHLOROETHENE	<5	<5	<5	<5	100.00	NR	NR	NR
1,2-DICHLOROPROPANE	<5	<5	<5	<5	<200	<12	<0.5	<0.5
ACETONE	<10	<10	<10	<10	<400	NR	NR	NR
AZULENE	NR	NR	NR	NR	NR	NR	NR	NR
BENZENE	<5	<5	<5	<5	<200	<12	<0.5	<0.5
BIS(2-ETHYLHEXYL)PHTHALATE	NR	NR	NR	NR	NR	NR	NR	NR
BROMACIL	NR	NR	NR	NR	NR	NR	NR	NR
CARBON_TETRACHLORIDE	<5	<5	<5	<5	6600.00	<12	<0.5	<0.5
CHLOROETHANE	<10	<10	<10	<10	<400	<12	<0.5	<0.5
CHLOROFORM	<5	<5	<5	<5	320.00	<12	<0.5	<0.5
CHLOROTRIFLUOROETHENE	NR	NR	NR	NR	NR	NR	NR	NR
cis-1,2-DICHLOROETHENE	NR	NR	NR	NR	NR	210.00	<0.5	<0.5
1,2-DICHLORO-1,1,2-T_ETHANE	NR	NR	NR	NR	NR	NR	NR	NR
METHYLENE_CHLORIDE	<5	<5	<5	3.00	<200	<12	<0.5	<0.5
NAPHTHALENE	NR	NR	NR	NR	NR	25.00	<0.5	<0.5
TETRACHLOROETHENE	<5	3.00	<5	<5	<200	24.00	<0.5	<0.5
TIC	NR	NR	NR	NR	NR	NR	NR	NR
TOLUENE	<5	<5	<5	<5	<200	<12	<0.5	<0.5
trans-1,2-DICHLOROETHENE	NR	NR	NR	NR	NR	NR	<12	<0.5
TRICHLOROETHENE	<5	4.00	<5	<5	3800.00	1300.00	<0.5	<0.5
VINYL_CHLORIDE	<10	<10	<10	<10	<400	<12	<0.5	<0.5

NR = Not Reported
< = The compound was analyzed but was not detected. The associated value is the sample quantification limit.
TIC = tentatively identified compound
µg/L = micrograms per liter

TABLE 4–5
Industrial Area IM/IRA/DD
Groundwater Analytical Results from Industrial Area Monitoring Wells, 4th Quarter 1993

Well Number Date Sampled Units	P416089 23–Nov–93 (µg/L)	P416189 21–Nov–93 (µg/L)	P416289 NA (µg/L)	P416389 23–Nov–93 (µg/L)	P416489 22–Nov–93 (µg/L)	P416589 21–Nov–93 (µg/L)	P416689 22–Nov–93 (µg/L)	P416789 23–Nov–93 (µg/L)
1,1,1–TRICHLOROETHANE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.60
1,1,2–TRICHLOROETHANE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2–TRICHLORO–1,2,2–TRIFLUOROETHANE	NR	NR	NR	NR	NR	NR	NR	20.00
1,1–DICHLOROETHANE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1–DICHLOROETHENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.00	0.60
1,2,3–TRICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,4–TRICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2–DICHLOROBENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2–DICHLOROETHANE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2–DICHLOROETHENE	NR	NR	NR	NR	NR	NR	NR	NR
1,2–DICHLOROPROPANE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ACETONE	NR	NR	NR	NR	NR	NR	NR	NR
AZULENE	NR	NR	NR	NR	NR	NR	NR	NR
BENZENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BIS(2–ETHYLHEXYL)PHTHALATE	NR	NR	NR	NR	NR	NR	NR	NR
BROMACIL	NR	NR	NR	NR	NR	NR	NR	NR
CARBON_TETRACHLORIDE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
CHLOROETHANE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
CHLOROFORM	<0.5	<0.5	17.00	<0.5	<0.5	<0.5	0.60	<0.5
CHLOROTRIFLUOROETHENE	NR	NR	NR	NR	NR	NR	NR	NR
cis–1,2–DICHLOROETHENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.70	6.00
1,2–DICHLORO–1,1,2–T_ETHANE	NR	NR	NR	NR	NR	NR	NR	0.80
METHYLENE_CHLORIDE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NAPHTHALENE	<0.5	<0.5	<0.5	0.50	<0.5	<0.5	<0.5	<0.5
TETRACHLOROETHENE	<0.5	<0.5	<0.5	<0.5	<0.5	0.70	3.00	7.00
TIC	NR	NR	NR	NR	NR	NR	NR	NR
TOLUENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans–1,2–DICHLOROETHENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TRICHLOROETHENE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.00	24.00
VINYL_CHLORIDE	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

NR = Not Reported
< = The compound was analyzed but was not detected. The associated value is the sample quantification limit.
TIC = tentatively identified compound
µg/L = micrograms per liter

TABLE 4-5
Industrial Area IM/IRA/DD
Groundwater Analytical Results from Industrial Area Monitoring Wells, 4th Quarter 1993

Well Number Date Sampled Units	P416889 23-Nov-93 (µg/L)	P416989 23-Nov-93 (µg/L)
1,1,1-TRICHLOROETHANE	1.00	<0.5
1,1,2-TRICHLOROETHANE	<0.5	<0.5
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	40.00	NR
1,1-DICHLOROETHANE	1.00	<0.5
1,1-DICHLOROETHENE	5.00	<0.5
1,2,3-TRICHLOROBENZENE	<0.5	<0.5
1,2,4-TRICHLOROBENZENE	<0.5	<0.5
1,2-DICHLOROBENZENE	<0.5	<0.5
1,2-DICHLOROETHANE	1.00	<0.5
1,2-DICHLOROETHENE	NR	NR
1,2-DICHLOROPROPANE	<0.5	<0.5
ACETONE	NR	NR
AZULENE	NR	NR
BENZENE	<0.5	<0.5
BIS(2-ETHYLHEXYL)PHTHALATE	NR	NR
BROMACIL	NR	NR
CARBON_TETRACHLORIDE	<0.5	<0.5
CHLOROETHANE	<0.5	<0.5
CHLOROFORM	0.90	<0.5
CHLOROTRIFLUOROETHENE	NR	NR
cis-1,2-DICHLOROETHENE	9.00	<0.5
1,2-DICHLORO-1,1,2-T_ETHANE	0.80	NR
METHYLENE_CHLORIDE	<0.5	<0.5
NAPHTHALENE	<0.5	<0.5
TETRACHLOROETHENE	35.00	<0.5
TIC	NR	NR
TOLUENE	<0.5	<0.5
trans-1,2-DICHLOROETHENE	<0.5	<0.5
TRICHLOROETHENE	5.00	<0.5
VINYL_CHLORIDE	<0.5	<0.5

NR = Not Reported
< = The compound was analyzed but was not detected. The associated value is the sample quantification limit.
TIC = tentatively identified compound
µg/L = micrograms per liter

certain sampling stations during 1992 and 1993. Footing drain sampling results are discussed in Section 7.0.

4.6 EVALUATION OF MONITORING PROGRAMS

Groundwater monitoring at RFP tends to be program-specific and regulation-driven. DOE has also established a plant protection mission for groundwater monitoring at RFP, under DOE Order 5400.1. The monitoring program and the wells in the monitoring network are subject to frequent review. The *Well Evaluation Report* identified the need for additional monitoring wells in the buffer zone, along the Woman Creek and Walnut Creek drainages. The RFP groundwater monitoring program was also recently evaluated for regulatory compliance and technical merit (Wright Water Engineers 1994).

For purposes of the IM/IRA, the locations of monitoring wells and frequency of sampling are generally adequate in the eastern Industrial Area. The OU4 and OU2 areas are monitored under the RCRA and CERCLA programs. Groundwater is sampled quarterly in these wells to meet technical and regulatory requirements. Groundwater monitoring coverage in the western and central Industrial Area is not adequate to provide early detection of contaminant releases to groundwater. Additional wells, suitably placed with respect to potential sources of contamination, are needed to intercept and monitor predicted migration pathways. The need exists for monitoring wells downgradient of the buildings and IHSSs identified in Section 3.0.

4.7 REAL-TIME MONITORING ALTERNATIVES ASSESSMENT

Real-time monitoring is generally not applicable to groundwater monitoring because of the relatively slow rates of contaminant migration and the limits of available technology. Real-time in situ monitoring can be applied to the following parameters: temperature, specific conductance, pH, salinity, and dissolved oxygen. Water levels may also be measured using real-time procedures.

4.8 RECOMMENDATIONS FOR GROUNDWATER MONITORING

The groundwater monitoring program at RFP is extensive and undergoes frequent evaluation. Modifications can be made to improve groundwater monitoring in the Industrial Area; this monitoring includes both existing wells and new wells.

4.8.1 Existing Wells and Piezometers

Table 4-6 lists three existing wells and 34 existing piezometers in the Industrial Area that are not included in the current RCRA and CERCLA monitoring well networks. These wells and piezometers (Figure 4-5) were recommended for incorporation into the routine groundwater monitoring program, for the purpose of the Industrial Area IM/IRA characterization, in the *Well Evaluation Report* (EG&G 1993a). The piezometers were installed in 1989 and are essentially located on a grid system. Several of these wells are strategically placed, relative to potential source areas, and will fill data gaps in the existing monitoring network. Others may be more useful for background or upgradient characterization for RFI/RIs. Because the purpose of this IM/IRA is early detection, not characterization, some of the piezometers are recommended for elimination from the IM/IRA monitoring well network. The rationale for selection of these wells and piezometers is given below and discussed in greater detail in Section 4.8.2.

In response to the *Well Evaluation Report*, the 37 wells and piezometers were sampled in late November and early December 1993. (See Section 4.5.) The analytical results were incomplete at the time of this writing. On the basis of the available information, 17 wells are designated for IM/IRA monitoring, and 10 are recommended conditionally. The list of IM/IRA wells should be finalized when VOC, metals, and radionuclide data are received for all wells. Wells will be recommended for IM/IRA sampling based both on constituents detected and identified potential sources.

TABLE 4–6
Industrial Area IM/IRA/DD
Existing Monitoring Wells Considered for Sampling Under the IM/IRA Monitoring Program

WELLS RECOMMENDED FOR IM/IRA SAMPLING PROGRAM:

	WELL NAME	STATE NORTH	STATE EAST	GENERAL AREA	WELL STATUS	CURRENT WELL CLASS	WELL PURPOSE	COMPLETION UNIT/LITHOLOGY
1	1986	750894	2083296	Plant North (PA)	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Kclst
2	2186	750855	2082501	Plant North (PA)	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Kss & Kslt clst
3	6186	749198	2083717	881 Hillside	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
4	P114689	749943	2083044	Plant Central	ACTIVE		Industrial Area IM/IRA Monitoring	Qrf
5	P114789	749940	2082610	Plant WC	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
6	P114889	749926	2082127	Plant WC	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
7	P115489	749507	2082135	Plant WC	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
8	P115589	749551	2082658	Plant WC	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
9	P115689	749532	2083019	Plant Central	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
10	P213989	750468	2086102	Plant NE	ACTIVE	RCRA	Industrial Area IM/IRA Monitoring	Qrf
11	P215789	749470	2083430	Plant Central	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
12	P314289	748216	2083280	Plant SC	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
13	P416589	748211	2081546	Plant SW	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
14	P416689	748147	2081941	Plant SW	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
15	P416789	748206	2082382	Plant SW/SC	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
16	P416889	748206	2082815	Plant SC	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf
17	P419689	748522	2082513	Plant SC	ACTIVE	Special Purpose	Industrial Area IM/IRA Monitoring	Qrf & Kss

WELLS CONDITIONALLY RECOMMENDED FOR IM/IRA SAMPLING PROGRAM:

	WELL NAME	STATE NORTH	STATE EAST	GENERAL AREA	WELL STATUS	CURRENT WELL CLASS	WELL PURPOSE	COMPLETION UNIT/LITHOLOGY
1	P114589	750396	2081731	Plant NW	ACTIVE	Special Purpose	Possible Industrial Area IM/IRA Monitoring	Qrf
2	P119389	750280	2081921	Plant West (PA)	ACTIVE	Special Purpose	Possible Industrial Area IM/IRA Monitoring	Qrf
3	P213689	749460	2083736	Plant Central	ACTIVE	Special Purpose	Possible Industrial Area IM/IRA Monitoring	Qrf
4	P313489	748913	2083062	Plant SC	ACTIVE	Special Purpose	Possible Industrial Area IM/IRA Monitoring	Qrf
5	P313589	748510	2083547	Plant SC	ACTIVE	Special Purpose	Possible Industrial Area IM/IRA Monitoring	Qrf
6	P414189	749059	2082986	Plant Central	ACTIVE	Special Purpose	Possible Industrial Area IM/IRA Monitoring	Qrf
7	P415889	749125	2080718	Plant WC	ACTIVE	Special Purpose	Possible Industrial Area IM/IRA Monitoring	Qrf
8	P416289	748598	2081555	Plant SW	ACTIVE	Special Purpose	Possible Industrial Area IM/IRA Monitoring	Qrf
9	P416389	748313	2080631	Plant SW	ACTIVE	Special Purpose	Possible Industrial Area IM/IRA Monitoring	Qrf
10	P416989	748780	2081034	Plant SW	INACTIVE	Special Purpose	Possible Industrial Area IM/IRA Monitoring	Kslt & Kslt

TABLE 4-6
Industrial Area IM/IRA/DD
Existing Monitoring Wells Considered for Sampling Under the IM/IRA Monitoring Program

WELLS RECOMMENDED FOR EXCLUSION FROM IM/IRA SAMPLING PROGRAM:

	WELL NAME	STATE NORTH	STATE EAST	GENERAL AREA	WELL STATUS	CURRENT WELL CLASS	WELL PURPOSE	COMPLETION UNIT/LITHOLOGY
1	P114389	750990	2081739	Plant NW	ACTIVE	Special Purpose	Hydrogeologic Characterization	Qrf
2	P114489	750337	2081246	Plant NW	ACTIVE	Special Purpose	Hydrogeologic Characterization	Qrf
3	P114989	749959	2081661	Plant NW/WC	ACTIVE	Special Purpose	Hydrogeologic Characterization	Qrf
4	P115089	749930	2081258	Plant NW/WC	ACTIVE	Special Purpose	Hydrogeologic Characterization	Qrf
5	P213889	750466	2086109	Plant NE	ACTIVE	RCRA	Hydrogeologic Characterization	Kss & Kcss
6	P314089	749461	2083653	Plant Central	ACTIVE		Hydrogeologic Characterization	Qrf
7	P415989	749025	2081011	Plant SW/WC	ACTIVE	Special Purpose	Hydrogeologic Characterization	Qrf
8	P416089	748605	2080720	Plant SW	ACTIVE	Special Purpose	Hydrogeologic Characterization	Qrf
9	P416189	748606	2081120	Plant SW	ACTIVE	Special Purpose	Hydrogeologic Characterization	Qrf
10	P416489	748210	2081113	Plant SW	ACTIVE	Special Purpose	Hydrogeologic Characterization	Qrf

INDEX:

STATE NORTH = state plane coordinates, Northing.
STATE EAST = state plane coordinates, Easting.

GENERAL LOCATION:
- PA = Protected Area
- NW = northwest
- WC = west central
- SW = southwest
- SC = south central
- NE = northeast

SURFACE ELEV. = land surface elevation at well head, in feet above mean sea level.
TD = total depth of casing, in feet below ground surface.
TOP SCRN = top of screened interval, measured in feet below ground surface.
BOT SCRN = bottom of screened interval, in feet below ground surface.
TOP BEDROCK = top of bedrock, in feet below ground surface.

COMPLETION UNIT/LITHOLOGY = rock type in which well is screened:
- Kss = Cretaceous sandstone
- Kclst = Cretaceous claystone
- Kcslt = Cretaceous clayey siltstone
- Kcss = Cretaceous clayey sandstone
- Kscist = Cretaceous sandy claystone
- Kslt = Cretaceous siltstone
- Kslticlst = Cretaceous silty claystone
- Kslts = Cretaceous silty sandstone
- Kssit = Cretaceous sandy siltstone
- Qa = Quaternary alluvium
- Qc = Quaternary colluvium
- Qrf = Quaternary Rocky Flats Alluvium

WELL CLASSIFICATION:
- RCRA-C = RCRA characterization monitoring wells - information used to determine the rate and extent of migration of hazardous waste
- RCRA-S = monitoring wells used for RCRA statistical comparisons [40 CFR 265.93(b) and 265.94(a)(2)(ii)]
- CERCLA = monitoring wells specified in RFI/RI work plans. Industrial Area IM/IRA characterization wells will convert to "Plant Protection" wells.
- Special Purpose = wells not incorporated into RCRA, CERCLA, Boundary, or Background sampling programs

4.8.2 Additional Monitoring Wells

The central portion of the plant lacks sufficient coverage by monitoring wells. Eleven additional monitoring wells are recommended in the alluvium of the upper hydrostratigraphic unit. Two wells are recommended in bedrock (Figure 4-6) to assess water quality at depth in the Laramie Formation. The recommended locations were field checked for accessibility by a drill rig and/or geoprobe vehicle. The locations and a brief justification for each are presented in Table 4-7 and are discussed in detail below.

Paired bedrock and alluvial wells are recommended where building footing drains exist in bedrock and where past analysis of footing drain waters indicated elevated levels of radiochemicals or UBC has been documented. The bedrock wells should be sited and constructed in a manner to reduce the potential for cross-contamination between the upper hydrostratigraphic unit and the bedrock. Double-cased wells, recommended in bedrock, are schematically represented in Figure 4-7.

Monitoring Wells A, M, and N. Monitoring wells are scarce in the vicinity of Buildings 371 and 374, where groundwater gradients are generally northeast. A northeast-trending groundwater divide apparently corresponds to the topographic divide between the main Walnut Creek drainage to the north and a northeast-trending tributary drainage, east of the 371/374 complex. Groundwater flows generally north and east from the divide. Wells are recommended in both directions to detect potential releases to groundwater from the 371/374 complex.

To the north of the 371/374 complex, three wells were installed in proximity. Two of those wells, installed in 1981, have since been abandoned. Bedrock Well 2186, screened from 33.84 to 66.04 feet below ground surface, is classified as Special Purpose (EG&G 1993j; EG&G 1993a). The well is monitored quarterly for water-level elevations and is recommended for incorporation into the IM/IRA monitoring network (Table 4-6).

Historical data from well 2186 indicate that radionuclides (gross alpha, gross beta, uranium-233, uranium-234, uranium-238, plutonium, and americium) have been detected. Three additional (new) wells are recommended in the 371/374 area, at locations A, M, and N in Figure 4-6.

Monitoring Well B. One additional well is recommended in the unnamed tributary to North Walnut Creek that drains the Protected Area between the 300 and 700 areas. The drainage currently contains two monitoring wells. Well 1986 is a shallow (12-foot) alluvial (colluvial) well located in the drainage bottom and is recommended for IM/IRA sampling (Table 4-6). Farther down in the drainage, Well 77492 is screened from 12 to 22 feet below top of casing (BTOC) in Rocky Flats Alluvium; it is a CERCLA characterization well that is sampled quarterly. Groundwater flow is north-northwest from the 558/565 area, and the additional well is recommended upgradient, closer to potential source areas. An alluvial well is recommended at Location B northeast of Building 565 (Figure 4-6) (50 feet northeast [N58°E] of the northwest corner of Building 565).

Monitoring Well C. One additional monitoring well is recommended to be installed south of the 371/374 complex. Groundwater in this vicinity flows generally northeast. This area currently does not contain any monitoring wells, and the closest monitoring wells, P114789 and P114689, are approximately 400 feet south and 600 feet southeast, respectively. An evaluation of analytical results from groundwater obtained from P114789 and P114689 from November 1993 indicated concentrations of volatile organics 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, TCE, and PCE. In addition, monitoring well P114689 had a detection of carbon tetrachloride. Gross alpha and gross beta were detected as dissolved constituents in these monitoring wells ranging from 6.3 to 38 picocuries per gram (pCi/g). An additional monitoring well is recommended at Location C (Figure 4-6).

TABLE 4-7
Industrial Area IM/IRA/DD
Recommended Monitoring Well Locations, Clearance Considerations, and Justification

WELL	LOCATION	FIELD CHECK CONSIDERATIONS	UTILITY LINE CONSIDERATIONS	JUSTIFICATION
A	North of Building 371 (approximately 100' N of 371, 25'W of T371H)	Flat area, can easily maneuver drill rig between small buildings	RFP Site Utility Plans, Drawing #15501-Map not available; area is expected to be clear.	- Downgradient north of Building 371 - Documented UBC, IHSSs 151 and 212 - Only one well in area (bedrock well 2186)
B	Upper tributary drainage, NE of 565 (50' N58°E of NW corner of Building 565)	Gentle slope, area is clear	RFP Site Utility Plans, Drawing #15501-20 Area is apparently clear of underground utilities.	- Downgradient NNW of Buildings 559, 565 - 559 stores 19+ listed chemicals - Documented UBC in 559 - Only two wells (1986 & 77492, alluvial) in drainage.
C	East of 371/374 complex, in upper tributary drainage	Not field checked		- Downgradient of well P114889 (elevated VOCs), near IHSS 156.1, 186, 188. - Currently, no wells exist in upper tributary drainage. - Downgradient wells P114789 and P114689 have shown elevated VOCs and radionuclides.
D	Between Buildings 558 and 707 (24' N40°E of SE corner of Bldg 559, N of Building 528)	Position drill rig between building and overhead pipes	RFP Site Utility Plans, Drawing #15501-20 - 9' E of copper utility pipe - 11' E of old process waste line - 17' NW of underground cable	- Downgradient east of Building 558, near IHSS 159 - Well P114689 ≈530 ft upgradient, contained elevated VOAs, Fall 1993

TABLE 4-7
Industrial Area IM/IRA/DD
Recommended Monitoring Well Locations, Clearance Considerations, and Justification
(continued)

WELL	LOCATION	FIELD CHECK CONSIDERATIONS	UTILITY LINE CONSIDERATIONS	JUSTIFICATION
E	North of Buildings 776 and 777 (145' due E of NW corner of 702, 62' W of 701)	Maneuver between small buildings. Area is flat	RFP Site Utility1 Plans, Drawing #15501-13 - 11' NE of underground structure - 14' W of 4' sanitary sewer - 11' S of 4' sanitary sewer - 24' N of old process waste line	- Downgradient north of 776\777 complex, in vicinity of IHSSs 118.1, 131,132, 144. - Potential under-building contamination - Nearest upgradient well is ≈1300 feet - ≈350 ft down/cross gradient P209389 & P209289 indicate elevated VOCs & radiochemicals
F	North of Building 771 (Paired alluvial/bedrock wells) (15' W of SW corner of T771A)	Position drill rig between small buildings. Area is flat	RFP Site Utility Plans, Drawing #15501-13 - 12' E of buried telephone line, 1'-8' deep - 19' N of 2400 volt electric cable - ≈44' N of old process waste line - ≈41' N of storm drain, vitrified clay pipe	- Downgradient north of Building 771 - 771 stores 16 listed chemicals - Documented UBC in 771 - near IHSSs 126.1 and 126.2, downgradient of IHSSs 118.1, 131, 132, and 144
H	Between Buildings 707 and 750 (54' S41°E of NW corner of Building 750)	Parking lot. Would require flush-mounted well completion	RFP Site Utility Plans, Drawing #15501-21 - 8' W of domestic cold water line - 9' SW of buried telephone cable - ≈17' N of storm sewer, vitrified clay pipe - 9' S42°E of storm drain	- Downgradient east of Building 707 - Downgradient of OPWL - General lack of well coverage - Elevated radionuclides at P218089, 260 feet SE

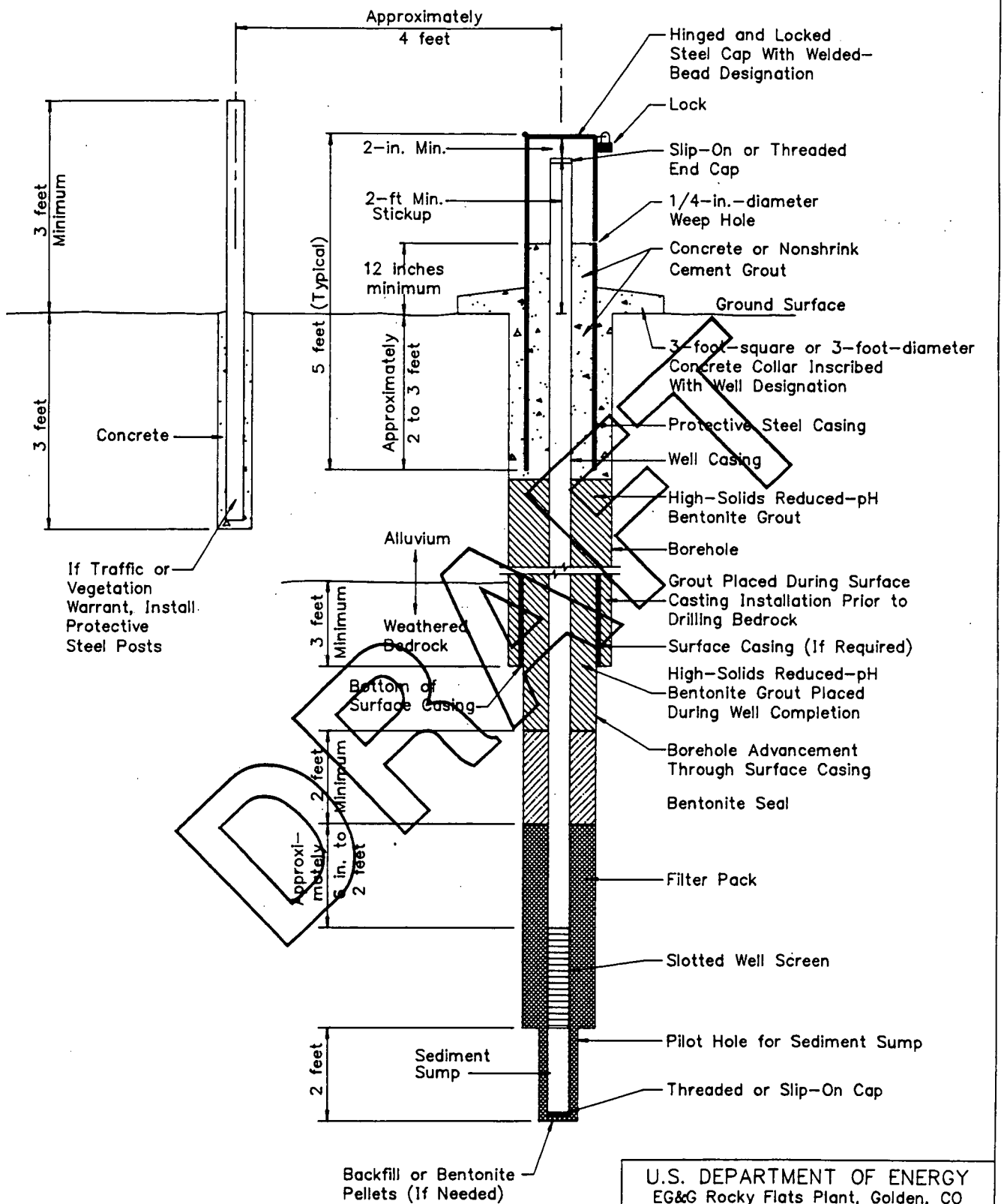
TABLE 4-7
Industrial Area IM/IRA/DD
Recommended Monitoring Well Locations, Clearance Considerations, and Justification
(continued)

WELL	LOCATION	FIELD CHECK CONSIDERATIONS	UTILITY LINE CONSIDERATIONS	JUSTIFICATION
J	Approximately 10' east of Building T886A	Clear, between buildings, and flat	RFP Site Utility Plans, Drawing #15501-Drawing not available. Area is expected to house fewer utilities than near well I. This well could substitute for I.	- Downgradient of Buildings 865 and 886 - P317989, 400 feet SW, has shown elevated radiochemicals
K	East of Building 444 (Paired alluvial/bedrock wells) (200' due E of the middle E corner of 444, ≈200' N of 664)	Gentle slope near RR tracks	RFP Site Utility Plans, Drawing #15501-41 - 55' E of railroad tracks - 19' E of 480 volt electric line - 13' W of underground cable, 2.5'-3' deep	- Downgradient east of Building 444 - Downgradient of IHSSs 136.2 and 207 - Only 2 downgradient-east wells (P419689, alluvial/bedrock; P313489, 700 feet east)
M	East of 371/374 complex	Level and clear, along fence line	RFP Site Utility Plans, Drawing #15501-Drawing not available	- Downgradient southeast of Building 371 - Documented UBC in 371 - Near IHSSs 151 and 212 - Only one well in area (bedrock Well 2186)
N	East of 371/374 complex	Level and clear, along fence line	RFP Site Utility Plans, Drawing #15501-Drawing not available	- Downgradient east of Building 371 - Documented UBC, IHSSs 151 and 212 - Only one well in area (bedrock Well 2186)

TABLE 4-7
Industrial Area IM/IRA/DD
Recommended Monitoring Well Locations, Clearance Considerations, and Justification
(continued)

Notes:

IHSS = Individual Hazardous Substance Site
RFP = Rocky Flats Plant
RR = railroad
UBC = under building contamination
VOCs = volatile organic compounds
# = number
' = feet
≈ = approximately



U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 4-7
INDUSTRIAL AREA IM/IRA/DD

Double-Cased
Well Construction Diagram

c:\rfets\sw\swfig47.dwg 05H60300

Monitoring Well D. One additional monitoring well is recommended between Buildings 558 and 707 at Location D (Figure 4-6), downgradient east of Building 558 near IHSS 159. The nearest well, P114689, approximately 530 feet upgradient, is screened from 17.8 to 22.2 feet in Rocky Flats Alluvium. An evaluation of analytical results from groundwater obtained from P114689, during the November 1993 sampling round, contained 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1-DCA, 1,1-DCE, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, CCl_4, methylene chloride, PCE, TCE, C_2H_3Cl, and cis-1,2-dichloroethene. Monitoring Well D is recommended downgradient, to intercept a potential contaminant plume and to detect potential releases from Building 558.

Monitoring Well E. An alluvial well is recommended downgradient north of Buildings 776 and 777 (145 feet due east of the northwest corner of Building 702 and 62 feet west of Building 701) at Location E (Figure 4-6), in the vicinity of IHSSs 118.1, 131, 132, and 144. Groundwater flow in the upper hydrostratigraphic unit is to the north, with a very slight westward component toward a paleotopographic drainage. The nearest upgradient wells, P215789 and P214089, are approximately 1,300 feet south-southwest. Currently, one set of paired wells (P209289 [alluvial, 12.7 feet BTOC] and P209389 [bedrock, 28.8 feet BTOC]), which is located approximately 200 feet north of Building 777, is sampled quarterly. Carbon tetrachloride, chloroform, and other organic compounds have been detected in both wells. Tritium and other radionuclides have been detected in small quantities in P209389. Proposed Well E will be located approximately 240 feet southwest (upgradient and cross gradient) of the existing piezometers and is recommended to fill the data gap and to detect potential releases from the 776/777 complex.

Monitoring Well F. One alluvial well and one bedrock well are recommended downgradient north (Location F) of Building 771, in the vicinity of IHSSs 126.1 and 126.2, and downgradient of IHSSs 118.1, 131, 132, and 144. Building 771 was used

for materials processing and refining; it houses an analytical and standards laboratory and waste drum storage. The potential for UBC has been reported. Footing drain data reveal high levels of radionuclides. The nearest well, P219189, is directly cross gradient. Nearby well P209289 is an active Special Purpose well, currently measured monthly for water-level elevations for hydrogeologic characterization, and has been dry for 12 of 50 sampling events. Proposed well Location F is farther removed from the seasonally unsaturated eastern hillslope and will provide early detection of releases to groundwater from Building 771.

Monitoring Well H. One well is recommended downgradient east of Building 707, at location H (Figure 4-6). Building 707 housed fabrications and assembly operations for plutonium. Groundwater flows to the east, with a slight southern component of flow. One abandoned well (5981) and one shallow piezometer (P218089, 7.4 feet BTOC) are located approximately 260 feet cross gradient southeast of the proposed location. P218089 is now classified as Special Purpose, for the investigation of the OPWL, and is sampled quarterly. Elevated tritium concentrations were observed in groundwater from this well during the 1990 sampling. Uranium-233, uranium-234, and uranium-238 have also been detected. An additional alluvial well would provide better coverage of this area. Access and well installation could be problematic, however, because of the extensive paved surfaces and underground utilities.

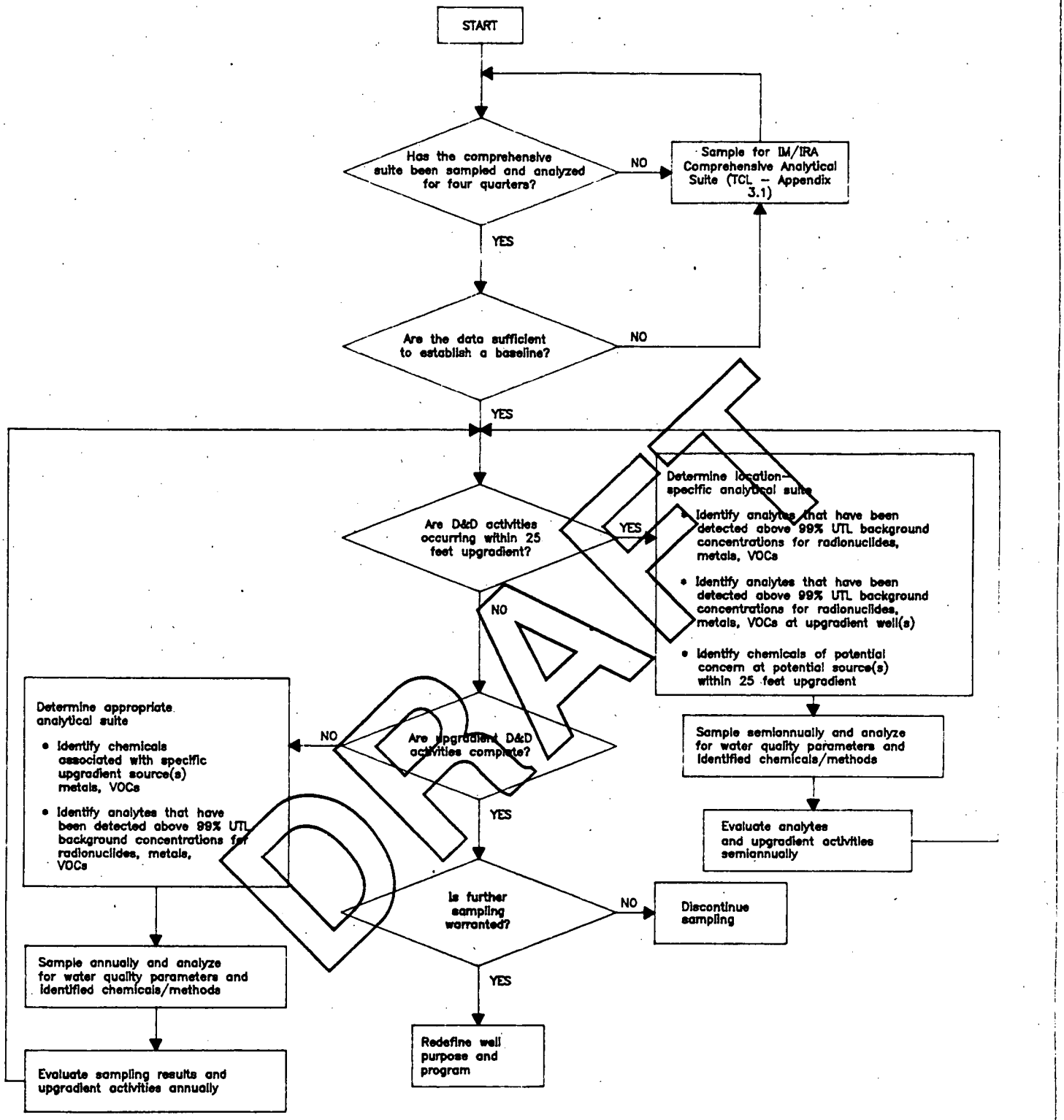
Monitoring Well J. An alluvial well is recommended in the vicinity of Buildings 865 and 886 at Location J (Figure 4-6). Groundwater in the upper hydrostratigraphic unit flows to the northeast. The nearest upgradient well that is currently sampled is approximately 1,900 feet west-southwest. Well 6186, which is recommended for IM/IRA sampling, is approximately 850 feet upgradient west. Well P317989, 400 feet southwest, has shown elevated levels of alpha particles, beta particles, tritium, uranium-233, uranium-234, and uranium-238.

Monitoring Well K. Two additional wells are recommended downgradient of Building 444, where groundwater flow is dominantly eastward. Flow in the upper hydrostratigraphic unit is to the southeast near Building 439. Paired alluvial and bedrock wells at Location K will be downgradient of IHSSs 136.2 and 207 and Building 444. The borehole of the existing downgradient piezometer, P419689 (23.5 feet BTOC, screened in alluvium and bedrock), yielded samples that were elevated in gross alpha, gross beta, tritium, and radium in 1989. This piezometer has not been incorporated into the routine sampling program but is recommended for quarterly sampling under the IM/IRA. The other nearest downgradient-east piezometer (P913489) is 700 feet from Building 445. Other wells and piezometers in the area are not in the eastward path of groundwater flow from Buildings 444 and 445.

4.8.3 Analytical Suite and Duration of Groundwater Sampling

Monitoring wells that are designated as part of the IM/IRA program should be evaluated regularly. A logic diagram indicating the factors to consider for determining analytes and monitoring duration for each well is indicated in Figure 4-8. It is recommended that wells that are retained under the IM/IRA monitoring program be sampled for the comprehensive list of analytes (Appendix 3.1) on a quarterly basis for at least one year to establish base-line groundwater chemistry.

After the first year, the sampling frequency should be dictated by upgradient activities for early detection of potential releases. Upgradient D&D activities that present the potential for environmental releases will necessitate frequent groundwater monitoring. Based on a conservatively high hydraulic conductivity of 1 x 10^{-4} cm/sec (0.3 ft/day), an effective porosity of 0.12 (determined for Arapahoe Formation sandstone, EG&G 1992h), and gradient of 0.05 ft/ft, groundwater could travel approximately 22 feet in a 180-day period. Therefore, it is recommended that IM/IRA monitoring wells be sampled semiannually if D&D activities are occurring within 25 feet upgradient. A location-specific analytical suite should be determined for each well, which includes constituents



Notes:
VOC = volatile organic compound
TCL = target compound list
UTL = upper tolerance limits

U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 4-8
INDUSTRIAL AREA IM/IRA/DD

Logic Diagram for Groundwater Monitoring Wells

that have been detected in that well and in any direct upgradient well as well as compounds of interest at the potential source area(s) upgradient.

If D&D activities are not occurring upgradient, annual sampling is recommended. The analytical suite should include constituents that have been detected in that well and in any direct upgradient well as well as COIs at the potential source area(s) within 50 feet upgradient. The 50-foot distance was determined as the approximate groundwater travel in 12 months based on the conservatively protective assumptions of 0.12 effective porosity, 1 x 10^{-4} cm/sec (0.3 ft/day) hydraulic conductivity, and a gradient of 0.05 ft/ft.

4.8.4 Geologic Characterization

Several data gaps exist in the geologic characterization of the subsurface below the Industrial Area. The need exists to determine the extent of sandstone channels in the lower hydrostratigraphic unit. Additional study of fracture occurrence in the Laramie Formation claystone and siltstone units is recommended.

4.8.5 Exploratory Boreholes

Before constructing the recommended monitoring wells, exploratory boreholes and/or sampling could be performed using geoprobe/hydropunch technology. These methods provide for a relatively inexpensive means of determining the occurrence and availability of groundwater. Such information will be useful to avoid drilling boreholes into unsaturated alluvium.

4.8.6 Laramie-Fox Hills Aquifer

The Laramie-Fox Hill aquifer is not considered a potential pathway. The aquifer could be investigated to confirm this assumption and to clearly establish the quality of groundwater downgradient of RFP. Special care would have to be taken to locate, drill,

and complete a well in a manner that minimizes the potential for contamination of the aquifer. Given the depth to the Laramie-Fox Hills aquifer, the low potential for RFP-derived contamination, the improbability of the aquifer as a contaminant pathway, and the expense of such an investigation, monitoring of the Laramie-Fox Hills aquifer is not recommended as part of this IM/IRA.

(intentionally blank)

APPENDIX 4.1
WATER-LEVEL MEASUREMENTS IN INDUSTRIAL AREA MONITORING WELLS, SPRING AND FALL 1992

(intentionally blank)

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water–Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
1386	4.38	02–APR–92	751857	2086051	Qc	5840.47	5842.59	9.50	3.09	9.50	9.00	5838.2
1486	11.69	02–APR–92	751856	2085838	Kss & Kclst	5844.71	5846.71	55.36	39.42	55.36	11.00	5835.0
1586	5.62	02–APR–92	751852	2085812	Qc	5848.43	5850.63	14.44	4.09	14.44	12.50	5845.0
1686	5.46	02–APR–92	751747	2085260	Kslts	5867.92	5869.55	45.06	39.06	45.06	7.00	5864.1
1786	5.37	02–APR–92	751740	2085242	Qc	5868.43	5869.57	13.98	3.73	13.98	12.50	5864.2
1886	8.83	02–APR–92	751522	2085831	Qc	5885.75	5887.97	7.50	3.74	7.50	8.00	5879.1
1986	2.34	02–APR–92	750894	2083896	Kclst	5943.08	5943.86	12.25	3.00	12.25	11.50	5941.5
2186	32.67	02–APR–92	750855	2082501	Kss & Kslt/clst	6004.76	6005.96	67.25	35.00	67.24	15.00	5973.3
2286	7.12	02–APR–92	750718	2084411	Qrf	5978.77	5979.55	11.20	3.20	11.20	11.00	5972.4
2386	83.93	02–APR–92	750338	2084259	Kslt & Kslt/clst	5982.46	5982.46	117.25	113.00	117.25	8.20	5898.5
2486	7.55	02–APR–92	750338	2084277	Qrf	5982.45	5983.56	7.45	2.95	7.45	7.20	5976.0
2586	30.43	03–APR–92	750412	2084831	Kslt/clst & Kclst	5975.24	5977.14	82.00	59.90	82.00	8.00	5946.7
2686	9.96	03–APR–92	750411	2084841	Qrf	5975.42	5977.17	11.00	3.75	11.00	10.50	5967.2
2786	80.62	02–APR–92	750781	2085238	Kslts & Kclst	5966.89	5963.88	133.00	128.50	133.00	11.00	5883.3
2986	7.43	02–APR–92	750599	2085687	Qrf	5959.58	5960.68	8.77	2.83	8.77	8.50	5953.3
3086	3.93	02–APR–92	751078	2084921	Kclst	5957.42	5958.39	14.93	2.48	14.93	2.50	5954.5
3186	DRY	02–APR–92	751051	2084764	Kss & Kslt	5964.98	5967.05	17.32	2.48	17.32	0.50	5967.1
3286	59.09	02–APR–92	751050	2084743	Kss & Kslts	5966.08	5967.92	125.50	114.90	125.50	1.00	5908.8
3386	5.97	02–APR–92	749950	2085003	Qrf	5951.40	5952.42	7.34	2.99	7.34	6.80	5946.5
4486	6.25	06–APR–92	749254	2082234	Qrf	6019.93	6021.98	26.25	3.23	26.25	25.50	6015.7
6186	8.88	06–APR–92	749198	2083717	Qrf	5999.47	6000.60	12.25	5.00	12.00	11.50	5991.7
0187	7.92	03–APR–92	748127	2083653	fill	5992.49	5994.08	12.08	3.38	11.83	11.80	5986.2
0587	43.62	01–APR–92	748081	2084849	Kss & Kslts	5927.85	5929.99	51.50	42.00	51.25	11.00	5886.4
1287	5.58	03–APR–92	748581	2086066	Kcslt	5934.61	5936.80	16.24	4.91	10.01	3.50	5930.7
2187	10.24	02–APR–92	749969	2085799	Qc	5928.43	5929.69	10.56	3.26	10.41	8.00	5919.5
2287	80.46	02–APR–92	749924	2085822	Kss & Kslt	5931.18	5932.80	88.70	81.41	88.46	12.80	5852.3
3787	5.92	02–APR–92	750494	2085224	Qrf	5967.52	5968.99	9.08	3.50	8.77	8.00	5963.1
3887	8.47	03–APR–92	750396	2085094	Qrf	5972.15	5973.90	9.50	3.50	9.27	7.80	5965.4
3987	84.88	02–APR–92	751081	2085268	Kslt & Kclst	5946.95	5948.42	117.39	109.99	117.14	3.50	5863.5
4387	7.9	01–APR–92	748030	2084788	Qc	5925.06	5926.41	12.50	3.50	12.25	12.00	5918.5
4487	3.92	03–APR–92	748306	2085435	Qc	5949.63	5951.10	3.70	1.50	3.50	3.20	5947.2
4587	91.15	03–APR–92	748313	2085451	Kss & Kslt & Kclst	5949.32	5950.91	101.30	89.50	97.05	4.00	5859.8
5687	7.08	02–APR–92	750638	2084423	Qrf	5978.39	5979.77	9.92	3.52	9.67	9.40	5972.7
1587	12.97	06–APR–92	749011	2086249	Qrf	5971.27	5972.79	22.53	5.80	22.06	21.90	5959.8
1687	86.46	06–APR–92	749130	2086249	Kslt	5969.49	5970.79	125.24	100.00	125.00	22.20	5884.3
1787	7.66	06–APR–92	749415	2086308	Qrf	5968.01	5969.56	25.75	3.50	25.50	25.00	5961.9
1887	129.46	06–APR–92	749404	2086339	Kss & Kslt	5967.99	5969.49	133.70	127.00	133.45	25.20	5840.0
1987	6.94	06–APR–92	749623	2086171	Qrf	5968.44	5969.91	11.89	3.50	11.65	10.80	5963.0
2087	110.49	06–APR–92	749634	2086155	Kslt/clst	5968.66	5970.14	116.36	107.26	116.11	11.80	5859.7
2387	11.25	06–APR–92	749404	2085910	Kslts & Kclst	5972.79	5974.49	37.85	17.19	37.61	15.20	5963.2

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water-Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
5087	DRY	03-APR-92	748123	2085334	Qc	5933.14	5934.78	13.70	3.50	13.50	12.50	5934.8
5187	15.47	06-APR-92	748103	2083850	fill?	5963.27	5965.22	14.00	3.58	13.84	12.50	5949.8
5287	9.47	06-APR-92	748145	2084067	fill?	5967.85	5969.57	20.50	3.50	20.25	20.00	5960.1
5387	4.61	06-APR-92	747985	2083912	Qc	5959.99	5961.81	9.30	3.50	9.05	10.00	5957.2
5487	3.2	06-APR-92	747985	2084032	Qc	5955.85	5957.62	4.68	1.33	4.53	4.00	5954.4
5687	6.93	06-APR-92	750638	2084423	Qrf	5978.39	5979.77	9.92	3.52	9.67	9.40	5972.8
B208089	11.57	02-APR-92	751143	2085876	Qc	5935.40	5937.07	14.16	3.40	12.90	12.20	5925.5
B208189	4.02	02-APR-92	751138	2085885	Kclst	5935.40	5937.46	27.58	16.90	26.34	11.00	5933.4
B208289	17.14	02-APR-92	751739	2086269	Kaltclst & Kclst	5850.70	5852.95	16.16	5.95	15.42	0.20	5835.8
B208389	DRY	02-APR-92	751687	2085984	Kaclst & Kclst	5876.80	5878.66	9.05	3.37	7.80	0.20	5878.7
B208489	DRY	02-APR-92	751683	2085836	Kclst	5876.30	5878.34	30.49	19.76	29.22	15.50	5878.3
B208589	3.39	02-APR-92	751804	2085477	Qc	5856.50	5858.35	5.07	3.23	3.99	3.60	5855.0
B208689	19.14	02-APR-92	751728	2085250	Kaltclst	5867.60	5869.60	23.07	12.32	21.80	7.30	5850.5
B208789	3.83	02-APR-92	751755	2084450	Qc	5907.10	5909.03	12.32	2.88	10.93	8.40	5905.2
B210489	3.37	02-APR-92	751802	2085513	Qc	5856.40	5858.71	8.67	2.98	7.41	7.00	5855.3
P114389	7.56	01-APR-92	750337	2081246	Qrf	6033.40	6035.43	50.10	44.40	48.80	48.30	6027.9
P114489	9.23	01-APR-92	750337	2081246	Qrf	6033.40	6035.43	50.10	44.40	48.80	48.30	6026.2
P114589	3.58	01-APR-92	750396	2081731	Qrf	6024.10	6025.90	37.60	32.54	36.50	27.50	6022.3
P114689	8.28	01-APR-92	749943	2083044	Qrf	6004.00	6005.76	23.50	17.83	22.24	22.00	5997.5
P114789	7.35	01-APR-92	749940	2082810	Qrf	6010.70	6012.40	27.60	21.81	26.23	26.00	6005.1
P114889	6.62	01-APR-92	749926	2082127	Qrf	6016.60	6018.26	15.55	9.89	14.30	13.80	6011.6
P114989	14.48	01-APR-92	749959	2081661	Qrf	6029.80	6031.84	39.30	33.59	38.00	37.50	6017.4
P115089	10.74	01-APR-92	749930	2081258	Qrf	6038.10	6040.10	42.01	36.27	40.70	40.20	6029.4
P115489	8.47	01-APR-92	749507	2082135	Qrf	6023.40	6025.10	27.75	22.09	26.50	26.00	6016.6
P115589	4.35	01-APR-92	749551	2082658	Qrf	6014.10	6015.77	30.70	25.05	29.48	29.00	6011.4
P115689	7.53	01-APR-92	749532	2083019	Qrf	6008.90	6008.71	21.31	16.23	20.20	19.70	6001.2
P119389	5.38	02-APR-92	750280	2081921	Qrf	6011.70	6013.18	18.21	12.50	16.90	16.40	6007.8
P207389	6.48	03-APR-92	750195	2084468	Kss & Kclst	5981.02	5982.77	16.22	10.53	15.16	7.00	5976.3
P207489	6.3	03-APR-92	750197	2084481	Qrf	5980.71	5982.64	8.23	2.39	7.00	6.50	5976.3
P207589	25.77	03-APR-92	750395	2084843	Kaltclst	5974.06	5975.96	25.10	14.40	23.86	9.40	5950.2
P207689	6.85	02-APR-92	750398	2085318	Qrf	5966.32	5967.88	14.36	3.64	13.10	12.60	5961.0
P207789	29.36	02-APR-92	750392	2085343	Kaltclst	5965.88	5967.75	28.63	17.90	27.34	12.90	5938.4
P207889	4.25	02-APR-92	750671	2085343	Qrf	5962.82	5964.90	8.95	3.26	7.70	8.50	5960.7
P207989	21.03	02-APR-92	750671	2085330	Kclst	5963.09	5965.17	21.73	11.00	20.48	5.80	5944.1
P208889	86.13	02-APR-92	751086	2085249	Kaltclst	5947.30	5949.25	99.16	87.76	96.94	5.50	5863.1
P208989	12.16	02-APR-92	751044	2084839	Kaltss & Kaltclst	5962.53	5964.56	26.12	15.40	24.84	3.50	5952.4
P209089	28.03	03-APR-92	750566	2084910	Kaltclst	5972.16	5974.25	27.21	16.50	25.96	11.50	5946.2
P209189	10.18	02-APR-92	750762	2084309	Kss & Kaltclst	5980.66	5982.21	36.08	13.30	35.01	10.30	5972.0
P209289	13.73	02-APR-92	750863	2084139	Qrf	5981.59	5983.42	13.40	8.20	12.66	12.20	5969.7
P209389	17.15	02-APR-92	750864	2084130	Kss & Kaltss & Kcss	5981.47	5983.39	30.05	16.82	28.80	13.80	5968.2

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water-Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/UTH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
P209489	26.5	02-APR-92	750991	2084634	Kas & Kaltss	5977.98	5980.10	36.25	15.48	35.00	9.00	5953.6
P209589	18.36	02-APR-92	751071	2085286	Kaltclst & Kaclst	5948.17	5950.04	19.77	9.07	18.52	4.10	5931.7
P209689	28.45	02-APR-92	750533	2085514	Kaltclst	5962.63	5964.43	27.93	17.20	26.67	12.20	5936.0
P209789	4.7	02-APR-92	750579	2085481	Qrf	5962.82	5964.94	13.75	3.00	12.50	12.00	5960.2
P209889	4.49	02-APR-92	751194	2084984	Kaltclst	5940.28	5942.40	19.63	8.89	18.33	3.90	5937.9
P209989	10.29	02-APR-92	751565	2084649	Qc	5898.10	5900.40	9.58	3.81	8.18	7.70	5890.1
P210089	19.21	02-APR-92	751564	2084669	Kaltclst	5898.40	5900.40	22.93	12.20	21.50	7.20	5881.2
P213689	8.54	01-APR-92	749460	2086736	Qrf	5994.30	5996.04	14.80	9.08	13.50	13.00	5987.5
P213889	DRY	02-APR-92	750466	2086108	Kas & Kcas	5954.10	5955.94	22.03	11.30	20.83	8.00	5955.9
P213989	DRY	02-APR-92	750468	2086102	Qrf	5954.30	5956.38	7.20	3.29	6.92	6.70	5956.4
P215789	13.87	01-APR-92	749470	2083430	Qrf	6002.00	6003.66	19.59	14.53	18.50	18.00	5989.8
P218089	5.16	02-APR-92	749941	2084020	Qrf	5985.80	5987.55	8.69	3.00	7.43	6.00	5982.4
P218389	8.83	02-APR-92	750831	2085648	Qrf	5956.20	5958.45	13.77	8.06	12.50	12.00	5949.6
P219189	9.77	02-APR-92	751222	2084010	Qc	5941.20	5943.15	12.77	7.08	11.50	11.00	5933.4
P219489	14.48	02-APR-92	750415	2085651	Qrf	5959.50	5961.15	24.20	18.48	22.90	22.50	5946.7
P219589	23.94	02-APR-92	750268	2085536	Kclst & Kaclst	5953.88	5965.70	26.99	21.27	25.70	17.20	5941.8
P313489	9.36	01-APR-92	748913	2083062	Qrf	6011.70	6013.58	22.37	16.71	21.10	20.60	6004.2
P313589	7.19	01-APR-92	748510	2083547	Qrf	6008.50	6010.11	13.76	8.08	12.50	11.00	6002.9
P314089	8.18	01-APR-92	749461	2083653	Qrf	5996.70	5998.49	11.06	5.37	9.79	9.30	5990.3
P314289	13.82	01-APR-92	748216	2083280	Qrf	6010.10	6011.77	14.80	9.11	13.51	13.00	5998.0
P414189	4.88	01-APR-92	749059	2082986	Qrf	6010.60	6012.18	19.78	14.09	18.50	18.00	6007.3
P415889	11.22	01-APR-92	749125	2080718	Qrf	6050.40	6052.60	44.50	38.75	43.20	49.50	6041.4
P415989	3.46	01-APR-92	749025	2081011	Qrf	6044.90	6046.71	28.00	22.30	26.73	34.00	6043.3
P416089	4.04	01-APR-92	748605	2080720	Qrf	6051.70	6053.95	35.39	29.24	34.00	33.50	6049.9
P416189	5.52	01-APR-92	748606	2081120	Qrf	6045.60	6047.95	30.94	25.23	29.66	29.20	6042.4
P416289	10.94	01-APR-92	748598	2081555	Qrf	6038.60	6040.22	24.77	19.07	23.50	23.00	6029.3
P416389	5.52	01-APR-92	748313	2080631	Qrf	6055.40	6057.14	31.40	25.69	30.10	30.00	6051.6
P416489	9.37	01-APR-92	748210	2081113	Qrf	6048.50	6050.15	26.98	21.27	25.70	25.20	6040.8
P416589	23.66	01-APR-92	748211	2081546	Qrf	6041.20	6042.81	32.10	27.04	31.00	30.50	6019.2
P416689	27.97	01-APR-92	748147	2081941	Qrf	6035.00	6036.55	33.76	28.09	32.50	32.00	6008.6
P416789	22.85	01-APR-92	748206	2082382	Qrf	6027.80	6029.27	28.20	22.48	26.90	26.40	6006.4
P416889	14.03	01-APR-92	748206	2082815	Qrf	6017.40	6018.79	21.52	15.86	20.27	20.20	6004.8
P207989	20.71	06-APR-92	750671	2085330	Kclst	5963.09	5965.17	21.73	11.00	20.48	5.80	5944.5
P317989	3.88	06-APR-92	748891	2084272	Qrf	5990.90	5992.84	8.73	3.00	7.49	6.40	5989.0
P320089	10.19	06-APR-92	748799	2083280	Qrf	6009.90	6011.87	20.08	14.38	18.81	18.80	6001.7
P418289	6.31	06-APR-92	748952	2082653	Qrf	6016.90	6018.20	26.70	9.60	23.50	23.00	6011.9
2391	DRY	03-APR-92	749853	2086600	Qrf	5956.82	5958.43	8.00	3.00	6.00	6.90	5956.4
07391	5.06	03-APR-92	748547	2085827	Qrf & Kclst	5949.14	5950.61	13.40	5.40	11.40	8.10	5945.6
09691	5.99	03-APR-92	748572	2086038	Kaltss & Kclst	5935.64	5937.05	16.00	6.00	14.00	3.10	5931.1
33491	10.76	03-APR-92	748080	2084883	Qc & Ksclst	5926.06	5928.59	11.10	6.68	8.69	8.00	5917.8

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water-Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
33691	10.93	03-APR-92	748112	2084994	Qc	5926.99	5929.24	10.60	6.19	8.11	7.80	5918.3
34591	12.8	03-APR-92	748462	2085621	Qc & Kclst	5952.19	5954.63	11.30	6.90	8.90	8.20	5941.8
34791	1.92	03-APR-92	748377	2085521	Qc	5951.39	5953.91	10.42	6.00	8.00	8.00	5952.0
36191	5.72	03-APR-92	748091	2084198	Qc	5962.89	5965.17	17.00	9.52	14.60	14.00	5959.5
36391	22.54	03-APR-92	748042	2084294	Qrf	5964.57	5967.01	29.80	17.43	27.41	26.40	5944.5
36691	26.68	03-APR-92	748027	2084421	Qs	5949.76	5951.52	27.83	15.83	25.83	25.00	5924.8
37191	5.61	03-APR-92	748036	2084533	Qc	5945.91	5948.29	23.07	11.12	21.07	20.50	5942.7
37591	5.73	03-APR-92	748580	2084610	Qrf	5991.42	5993.45	14.60	7.60	12.60	12.00	5987.7
37691	13.28	03-APR-92	748692	2085217	Qrf	5984.46	5985.24	18.50	6.51	16.50	16.20	5972.0
37891	38.94	03-APR-92	748075	2084915	Kcsltst & Kcltst	5925.22	5926.29	55.20	43.20	53.20	4.70	5887.4
37991	47.76	03-APR-92	748063	2084731	Kcsltst & Kcsltst	5931.45	5933.55	57.20	45.20	55.20	6.90	5885.8
38191	7.68	03-APR-92	748014	2084765	Qc	5924.47	5926.40	17.00	10.00	15.00	14.70	5918.7
38291	DRY	03-APR-92	748032	2084801	Qc	5924.49	5926.71	10.70	6.70	8.70	8.40	5926.7
39691	8.25	03-APR-92	748357	2083634	Qrf & Kclst	6006.26	6008.37	11.00	7.00	9.00	8.00	6000.1
06591	10.32	06-APR-92	749064	2085535	Kaclst & Kaltclst	5978.28	5979.78	50.00	33.00	48.00	15.40	5969.5
06891	6.24	06-APR-92	749258	2085883	Qrf	5974.14	5975.62	16.00	6.00	14.00	14.00	5969.4
06991	8.91	06-APR-92	749168	2085990	Qrf	5973.91	5974.57	31.00	14.00	29.00	28.60	5965.7
07191	14.57	06-APR-92	748850	2085908	Qrf	5974.79	5976.34	23.10	11.10	21.10	20.00	5961.8
07291	16.06	06-APR-92	748748	2085766	Qrf	5977.27	5978.80	22.60	10.60	20.60	20.00	5962.7
08891	12.77	06-APR-92	749128	2085866	Qrf	5976.36	5978.06	27.30	15.30	25.30	23.00	5965.3
09091	14.86	06-APR-92	748918	2085943	Qrf	5975.16	5976.79	26.70	14.70	24.70	24.00	5961.9
13191	11.6	06-APR-92	749071	2085530	Kaclst	5978.25	5979.99	27.70	15.70	25.70	15.40	5968.3
13291	9.21	06-APR-92	749060	2085523	Qrf	5978.48	5979.97	17.70	5.70	15.70	15.40	5970.8
35391	11.09	06-APR-92	748011	2083907	Kclst	5960.73	5963.08	10.50	6.10	8.11	6.00	5951.9
37791	19.54	06-APR-92	748592	2083753	Qrf	6002.16	6004.18	22.60	10.60	20.60	20.00	5984.6
SUPPLEMENTAL SPRING 1992 DATA:												
0987	14.83	07-APR-92	749068	2085348	Kss	5980.22	5981.70	32.40	14.50	32.15	12.50	5966.9
1087	13.05	07-APR-92	748946	2085290	Qrf	5981.95	5983.52	12.00	3.50	12.00	11.30	5970.5
3486	20.9	07-APR-92	750162	2086193	Kcss & Kcslt	5912.00	5913.95	56.25	44.24	56.25	16.00	5893.1
3586	6.15	07-APR-92	750167	2086219	Qc	5910.75	5912.76	11.60	4.86	11.60	10.50	5906.6
P207889	4.74	07-APR-92	750671	2085343	Qrf	5962.82	5964.90	8.95	3.26	7.70	8.50	5960.2
P210089	19.09	07-APR-92	751564	2084639	Kaltclst	5898.40	5900.40	22.93	12.20	21.50	7.20	5881.3
01791	8.89	08-APR-92	749504	2086018	Kaltss & Kaclst	5965.78	5967.41	20.00	10.00	18.00	8.00	5958.5
01891	9.1	08-APR-92	749438	2086023	Kaltss & Kaltclst	5971.76	5973.37	32.00	20.00	30.00	12.40	5964.3
02091	8.21	08-APR-92	749617	2086428	Kaclst, Kaslt, Kaltclst	5965.19	5966.65	32.60	15.60	30.60	16.10	5958.4
02291	8.08	08-APR-92	749880	2086139	Kaclst & Kcss	5936.66	5938.26	18.50	11.50	16.50	8.80	5930.2
02491	9.41	08-APR-92	749949	2086432	Kaltss, Kaslt	5944.54	5946.21	18.80	11.80	16.80	8.50	5936.8

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water–Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
02691	5.34	08–APR–92	750385	2086043	Kslts & Kslclst	5934.78	5936.38	18.00	6.00	16.00	1.10	5931.0
12091	9.77	08–APR–92	749436	2086009	Kslts	5971.59	5973.27	24.00	14.00	22.00	13.20	5963.5
12291	14.29	08–APR–92	749429	2085441	Kcss & Kss	5970.98	5972.73	16.10	7.10	14.10	2.00	5958.4
1986	2.53	08–APR–92	750894	2083296	Kslst	5943.08	5943.86	12.25	3.00	12.25	11.50	5941.3
33891	11.38	08–APR–92	747961	2084641	Qc & Kclst	5927.54	5929.94	11.10	6.70	8.70	8.10	5918.6
35991	18.03	08–APR–92	748057	2083758	Qc	5973.25	5976.45	16.10	8.68	13.70	12.20	5958.4
4386	12.9	08–APR–92	749404	2085869	Qrf	5972.91	5974.46	16.75	3.99	16.75	17.00	5961.6
2486	8.3	09–APR–92	750338	2084277	Qrf	5982.45	5983.56	7.45	2.95	7.45	7.20	5975.3
3987	83.23	09–APR–92	751081	2085288	Kslt & Kclst	5946.95	5948.42	117.39	109.99	117.14	3.50	5865.2
B208089	11.83	09–APR–92	751143	2085876	Qc	5935.40	5937.07	14.16	3.40	12.90	12.20	5925.2
B208189	5.03	09–APR–92	751138	2085885	Kclst	5935.40	5937.46	27.58	16.90	26.34	11.00	5932.4
P208889	84.81	09–APR–92	751086	2085249	Kslclst	5947.30	5949.25	99.16	87.76	96.94	5.50	5864.4
P209189	10.57	09–APR–92	750762	2084309	Kss & Kslclst	5980.66	5982.21	36.08	13.30	35.01	10.30	5971.6
P209589	18.06	09–APR–92	751071	2085286	Kslclst & Kscls	5948.17	5950.04	19.77	9.07	18.52	4.10	5932.0
P416989	16.37	09–APR–92	748780	2081034	Kslt & Kslt	6045.20	6047.55	157.95	151.16	155.61	30.00	6031.2
00191	9.32	13–APR–92	749237	2086244	Qrf	5968.86	5970.44	27.00	15.00	25.00	24.20	5961.1
01391	12.3	13–APR–92	749402	2085226	Qrf	5973.79	5975.30	16.00	6.00	14.00	14.50	5963.0
01491	14.34	13–APR–92	749430	2085474	Kss & Kcs	5970.87	5972.03	26.00	14.00	24.00	1.60	5957.7
02191	DRY	13–APR–92	749708	2086166	Qrf	5965.81	5967.51	15.00	8.00	13.00	13.50	5967.5
2286	7.72	13–APR–92	750718	2084411	Qrf	5978.77	5979.55	11.20	3.20	11.20	11.00	5971.8
2786	75.98	13–APR–92	750781	2085238	Kslts & Kslclst	5962.89	5963.88	133.00	128.50	133.00	11.00	5887.9
3386	6.4	13–APR–92	749950	2085003	Qrf	5951.40	5952.42	7.34	2.99	7.34	6.80	5946.0
3787	6.29	13–APR–92	750494	2085224	Qrf	5967.52	5968.99	9.00	3.50	8.77	8.00	5962.7
2686	10.47	14–APR–92	750411	2084841	Qrf	5975.42	5977.17	11.00	3.75	11.00	10.50	5966.7
P207589	25.62	14–APR–92	750395	2084843	Kslclst	5974.06	5975.96	25.10	14.40	23.86	9.40	5950.3
2187	9.57	15–APR–92	749969	2085799	Qc	5928.43	5929.69	10.56	3.26	10.41	8.00	5920.1
2287	80.44	15–APR–92	749924	2085822	Kss & Kslt	5931.18	5932.80	88.70	81.41	88.46	12.80	5852.4
P207689	7.15	15–APR–92	750398	2085318	Qrf	5966.32	5967.88	14.36	3.64	13.10	12.60	5960.7
P207789	29.23	15–APR–92	750392	2085343	Kslclst	5965.88	5967.75	28.63	17.90	27.34	12.90	5938.5
2186	32.62	16–APR–92	750855	2082501	Kss & Kslclst	6004.76	6005.86	67.25	35.00	67.24	15.00	5973.3
3186	DRY	20–APR–92	751051	2084764	Kss & Kslt	5964.98	5967.05	17.32	2.46	17.32	0.50	5967.1
3887	9.03	20–APR–92	750396	2085094	Qrf	5972.15	5973.90	9.50	3.50	9.27	7.80	5964.9
P208989	13.83	20–APR–92	751044	2084839	Kslts & Kslclst	5962.53	5964.56	26.12	15.40	24.84	3.50	5950.7
P209889	4.62	20–APR–92	751194	2084984	Kslclst	5940.28	5942.40	19.63	8.89	18.33	3.90	5937.8
P218089	5.44	20–APR–92	749941	2084020	Qrf	5985.80	5987.55	8.69	3.00	7.43	6.00	5982.1
5287	9.59	22–APR–92	748145	2084067	fill?	5967.85	5969.57	20.50	3.50	20.25	20.00	5960.0
6186	9.79	22–APR–92	749198	2083717	Qrf	5999.47	6000.60	12.25	5.00	12.00	11.50	5990.8
P209289	14.68	22–APR–92	750863	2084139	Qrf	5981.59	5983.42	13.40	8.20	12.66	12.20	5968.7
P317989	4.95	22–APR–92	748891	2084272	Qrf	5990.90	5992.84	8.73	3.00	7.49	6.40	5987.9
4486	6.9	23–APR–92	749254	2082234	Qrf	6019.93	6021.96	26.25	3.23	26.25	25.50	6015.1

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water–Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
P209389	18.53	23–APR–92	750864	2084130	Kas & Kaltss & Kcas	5981.47	5983.39	30.05	16.82	28.80	13.80	5964.9
P209489	27.97	23–APR–92	750991	2084634	Kas & Kaltss	5977.98	5980.10	36.25	15.48	35.00	9.00	5952.1
P209789	6.37	24–APR–92	750579	2085481	Qrf	5962.82	5964.94	13.75	3.00	12.50	12.00	5958.6
P418289	7.72	24–APR–92	748952	2082653	Qrf	6016.90	6018.20	26.70	9.60	23.50	23.00	6010.5
P209089	27.09	27–APR–92	750566	2084910	Kaltclst	5972.16	5974.25	27.21	16.50	25.96	11.50	5947.2
P209689	28.14	27–APR–92	750533	2085514	Kaltclst	5962.63	5964.43	27.93	17.20	26.67	12.20	5936.3
P320089	11.81	27–APR–92	748799	2083260	Qrf	6009.90	6011.87	20.08	14.38	18.81	18.80	6000.1
P207389	6.66	28–APR–92	750195	2084468	Kas & Kclst	5981.02	5982.77	16.22	10.53	15.18	7.00	5976.1
P207489	6.73	28–APR–92	750197	2084481	Qrf	5980.71	5982.64	8.23	2.39	7.00	6.50	5975.9
5387	6.12	29–APR–92	747985	2083912	Qc	5959.99	5961.81	9.30	3.50	9.05	10.00	5955.7
5487	4.28	29–APR–92	747985	2084032	Qc	5955.85	5957.62	4.68	1.33	4.53	4.00	5953.3
1787	10.86	30–APR–92	749415	2086308	Qrf	5968.01	5969.56	25.75	3.50	25.50	25.00	5958.7
2986	9.06	30–APR–92	750599	2085687	Qrf	5959.58	5960.68	8.77	2.83	8.77	8.50	5951.6
3086	5.02	30–APR–92	751078	2084921	Kclst	5957.42	5958.39	14.93	2.48	14.93	2.50	5953.4
P209989	10.43	30–APR–92	751565	2084649	Qc	5898.10	5900.40	9.58	3.81	8.18	7.70	5890.0
1386	5.02	14–APR–92	751857	2086051	Qc	5840.47	5842.59	9.50	3.09	9.50	9.00	5837.6
1486	11.52	14–APR–92	751856	2085838	Kas & Kaclst	5844.71	5846.71	55.36	39.42	55.36	11.00	5835.2
1586	6.32	13–APR–92	751852	2085812	Qc	5848.43	5850.63	14.44	4.09	14.44	12.50	5844.3
1686	5.5	07–APR–92	751747	2085260	Kaltss	5867.92	5869.55	45.06	39.06	45.06	7.00	5864.1
1786	6.02	07–APR–92	751740	2085242	Qc	5868.43	5869.57	13.98	3.73	13.98	12.50	5863.6
1886	9	09–APR–92	751522	2085831	Qc	5885.75	5887.97	7.50	3.74	7.50	8.00	5879.0
37791	19.54	06–APR–92	748592	2083753	Qrf	6002.16	6004.18	22.60	10.60	20.60	20.00	5984.6
B208289	17.09	09–APR–92	751739	2086289	Kaltclst & Kclst	5850.70	5852.95	16.16	5.95	15.42	0.20	5835.9
B208589	3.95	09–APR–92	751804	2085477	Qc	5856.50	5858.35	5.07	3.23	3.99	3.60	5854.4
B208689	18.59	07–APR–92	751728	2085250	Kaltclst	5867.60	5869.60	23.07	12.32	21.80	7.30	5851.0
B208789	3.97	08–APR–92	751755	2084450	Qc	5907.10	5909.03	12.32	2.88	10.93	8.40	5905.1
B210489	4.16	10–APR–92	751802	2085513	Qc	5856.40	5858.71	8.67	2.98	7.41	7.00	5854.6
FALL 1992 WATER LEVEL DATA:												
1386	8.11	02–OCT–92	751857	2086051	Qc	5840.47	5842.59	9.50	3.09	9.50	9.00	5834.5
1486	10.91	02–OCT–92	751856	2085838	Kas & Kaclst	5844.71	5846.71	55.36	39.42	55.36	11.00	5835.8
1586	7.16	02–OCT–92	751852	2085812	Qc	5848.43	5850.63	14.44	4.09	14.44	12.50	5843.5
1686	6.66	02–OCT–92	751747	2085260	Kaltss	5867.92	5869.55	45.06	39.06	45.06	7.00	5862.9
1786	6.61	02–OCT–92	751740	2085242	Qc	5868.43	5869.57	13.98	3.73	13.98	12.50	5863.0
1886	DRY	02–OCT–92	751522	2085831	Qc	5885.75	5887.97	7.50	3.74	7.50	8.00	5888.0
1986	3.07	05–OCT–92	750894	2083296	Kclst	5943.08	5943.86	12.25	3.00	12.25	11.50	5940.8
2186	33.86	05–OCT–92	750855	2082501	Kas & Kaltclst	6004.76	6005.96	67.25	35.00	67.24	15.00	5972.1
2286	10.03	05–OCT–92	750718	2084411	Qrf	5978.77	5979.55	11.20	3.20	11.20	11.00	5969.5

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water–Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
2386	88.05	05–OCT–92	750338	2084259	Kslt & Ksltclst	5982.46	5982.46	117.25	113.00	117.25	8.20	5894.4
2486	DRY	05–OCT–92	750338	2084277	Qrf	5982.45	5983.56	7.45	2.95	7.45	7.20	5983.6
2586	30.16	05–OCT–92	750412	2084831	Kslt/clst & Kclst	5975.24	5977.14	82.00	59.90	82.00	8.00	5947.0
2686	12	05–OCT–92	750411	2084841	Qrf	5975.42	5977.17	11.00	3.75	11.00	10.50	5965.2
2786	77	05–OCT–92	750781	2085238	Kslts & Kslst	5962.89	5963.88	133.00	128.50	133.00	11.00	5886.9
2986	DRY	05–OCT–92	750599	2085687	Qrf	5959.58	5960.68	8.77	2.83	8.77	8.50	5960.7
3086	7.36	05–OCT–92	751078	2084921	Kclst	5957.42	5958.39	14.93	2.48	14.93	2.50	5951.0
3186	19.56	05–OCT–92	751051	2084764	Kss & Kslt	5964.98	5967.05	17.32	2.46	17.32	0.50	5947.5
3286	53.91	05–OCT–92	751050	2084743	Kss & Kslts	5966.08	5967.92	125.50	114.90	125.50	1.00	5914.0
3386	8.68	05–OCT–92	749950	2085003	Qrf	5951.40	5952.42	7.34	2.99	7.34	6.80	5943.7
3486	21.5	01–OCT–92	750162	2086193	Kcss & Kcslt	5912.00	5913.95	56.25	44.24	56.25	16.00	5892.5
3586	9.87	01–OCT–92	750167	2086219	Qc	5910.75	5912.76	11.60	4.86	11.60	10.50	5902.9
4386	DRY	01–OCT–92	749404	2085869	Qrf	5972.91	5974.46	16.75	3.99	16.75	17.00	5974.5
4486	8.14	01–OCT–92	749254	2082234	Qrf	6019.93	6021.96	26.25	3.23	26.25	25.50	6013.8
0187	10.41	01–OCT–92	748127	2083853	fill	5992.49	5994.08	12.08	3.38	11.83	11.80	5983.7
0587	44.59	01–OCT–92	748081	2084849	Kss & Kslts	5927.85	5929.99	51.50	42.00	51.25	11.00	5885.4
0987	19.39	02–OCT–92	749068	2085348	Kss	5980.22	5981.70	32.40	14.50	32.15	12.50	5962.3
1087	DRY	01–OCT–92	748946	2085290	Qrf	5981.95	5983.52	12.00	3.50	12.00	11.30	5983.5
1087	13.77	02–OCT–92	748946	2085290	Qrf	5981.95	5983.52	12.00	3.50	12.00	11.30	5969.8
1287	10.87	02–OCT–92	748581	2086066	Kcslt	5934.81	5936.30	10.24	4.91	10.01	3.50	5925.4
1587	21.77	02–OCT–92	749011	2086249	Qrf	5971.27	5972.79	22.53	5.80	22.06	21.90	5951.0
1687	90.53	02–OCT–92	749130	2086249	Kslt	5969.49	5970.79	125.24	100.00	125.00	22.20	5880.3
1787	21.2	01–OCT–92	749415	2086308	Qrf	5968.01	5969.56	25.75	3.50	25.50	25.00	5948.4
1887	127.09	01–OCT–92	749404	2086339	Kss & Kslt	5967.99	5969.49	133.70	127.00	133.45	25.20	5842.4
1987	13.72	01–OCT–92	749623	2086171	Qrf	5968.44	5969.91	11.89	3.50	11.65	10.80	5956.2
2087	108.8	01–OCT–92	749634	2086155	Kslt/clst	5968.66	5970.14	116.36	107.26	116.11	11.80	5861.3
2187	7.84	05–OCT–92	749969	2085799	Qc	5928.43	5929.69	10.56	3.26	10.41	8.00	5921.9
2287	80.57	05–OCT–92	749924	2085822	Kss & Kslt	5931.18	5932.80	96.70	81.41	88.46	12.80	5852.2
2387	18.87	01–OCT–92	749404	2085910	Kslts & Kclst	5972.79	5974.49	37.85	17.19	37.61	15.20	5955.6
3787	9.49	05–OCT–92	750494	2085224	Qrf	5967.52	5968.99	9.00	3.50	8.77	8.00	5959.5
3887	11.15	05–OCT–92	750396	2085094	Qrf	5972.15	5973.00	9.50	3.50	9.27	7.80	5962.8
3987	89.54	05–OCT–92	751081	2085268	Kslt & Kclst	5946.95	5948.42	117.39	109.99	117.14	3.50	5858.9
4387	9.73	01–OCT–92	748030	2084788	Qc	5925.06	5926.41	12.50	3.50	12.25	12.00	5916.7
4487	DRY	01–OCT–92	748306	2085435	Qc	5949.63	5951.10	3.70	1.50	3.50	3.20	5951.1
4587	90.74	01–OCT–92	748313	2085451	Kss & Kslt & Kclst	5949.32	5950.91	101.30	89.50	97.05	4.00	5860.2
5087	DRY	01–OCT–92	748123	2085334	Qc	5933.14	5934.78	13.70	3.50	13.50	12.50	5934.8
5387	10.94	01–OCT–92	747985	2083912	Qc	5959.99	5961.81	9.30	3.50	9.05	10.00	5950.9
5487	6	01–OCT–92	747985	2084032	Qc	5955.85	5957.62	4.68	1.33	4.53	4.00	5951.6
5687	8.48	05–OCT–92	750638	2084423	Qrf	5978.39	5979.77	9.92	3.52	9.67	9.40	5971.3
B208089	13.22	02–OCT–92	751143	2085876	Qc	5935.40	5937.07	14.16	3.40	12.90	12.20	5923.9

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water-Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/UTH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
B208089	13.27	05-OCT-92	751143	2085876	Qc	5935.40	5937.07	14.16	3.40	12.90	12.20	5923.8
B208189	22.88	02-OCT-92	751138	2085885	Kclst	5935.40	5937.46	27.58	16.90	26.34	11.00	5914.6
B208189	22.72	05-OCT-92	751138	2085885	Kclst	5935.40	5937.46	27.58	16.90	26.34	11.00	5914.7
B208289	17.33	02-OCT-92	751739	2086289	Kaltclst & Kclst	5850.70	5852.95	16.16	5.95	15.42	0.20	5835.6
B208389	DRY	02-OCT-92	751687	2085584	Kaclst & Kclst	5876.80	5878.66	9.05	3.37	7.80	0.20	5878.7
B208489	DRY	02-OCT-92	751683	2085638	Kclst	5876.30	5878.34	30.49	19.76	29.22	15.50	5878.3
B208589	DRY	02-OCT-92	751804	2085477	Qc	5856.50	5858.35	5.07	3.23	3.99	3.60	5858.4
B208689	14.8	02-OCT-92	751728	2085250	Kaltclst	5867.60	5869.60	23.07	12.32	21.80	7.30	5854.8
B208789	9.77	02-OCT-92	751755	2084460	Qc	5907.10	5909.03	12.32	2.88	10.93	8.40	5899.3
B210489	6.42	02-OCT-92	751802	2085513	Qc	5856.40	5858.71	8.67	2.98	7.41	7.00	5852.3
P114389	8.17	01-OCT-92	750337	2081246	Qrf	6033.40	6035.43	50.10	44.40	48.80	48.30	6027.3
P114489	14.58	01-OCT-92	750337	2081246	Qrf	6033.40	6035.43	50.10	44.40	48.80	48.30	6020.9
P114589	7.64	01-OCT-92	750396	2081731	Qrf	6024.10	6025.90	37.60	32.54	36.50	27.50	6018.3
P114689	12.24	01-OCT-92	749943	2083044	Qrf	6004.00	6005.76	23.50	17.83	22.24	22.00	5993.5
P114789	8.04	01-OCT-92	749940	2082610	Qrf	6010.70	6012.40	27.60	21.81	26.23	26.00	6004.4
P114889	5.52	01-OCT-92	749926	2082127	Qrf	6016.60	6018.26	15.55	9.89	14.30	13.80	6012.7
P114989	12.77	01-OCT-92	749959	2081661	Qrf	6029.80	6031.84	39.30	33.59	38.00	37.50	6019.1
P115089	15.89	01-OCT-92	749930	2081258	Qrf	6038.10	6040.10	42.01	36.27	40.70	40.20	6024.2
P115489	11.28	01-OCT-92	749507	2082135	Qrf	6023.40	6025.10	27.75	22.09	26.50	26.00	6013.8
P115589	8.17	01-OCT-92	749551	2082658	Qrf	6014.10	6015.77	30.70	25.05	29.48	29.00	6007.6
P115689	13.02	01-OCT-92	749532	2083019	Qrf	6008.80	6008.71	21.31	16.23	20.20	19.70	5995.7
P119389	5.73	05-OCT-92	750280	2081921	Qrf	6011.70	6013.18	18.21	12.50	16.90	16.40	6007.5
P207389	8.69	05-OCT-92	750195	2084468	Kas & Kclst	5981.02	5982.77	16.22	10.53	15.18	7.00	5974.1
P207489	8.53	05-OCT-92	750197	2084481	Qrf	5980.71	5982.64	8.23	2.39	7.00	6.50	5974.1
P207589	25.58	05-OCT-92	750395	2084843	Kaltclst	5974.06	5975.96	25.10	14.40	23.86	9.40	5950.4
P207689	8.74	05-OCT-92	750398	2085318	Qrf	5966.32	5967.88	14.36	3.64	13.10	12.60	5959.1
P207789	29.17	05-OCT-92	750392	2085343	Kaltclst	5965.88	5967.78	28.63	17.90	27.34	12.90	5938.6
P207889	10.08	05-OCT-92	750671	2085343	Qrf	5962.82	5964.90	8.95	3.26	7.70	8.50	5954.8
P207989	18.45	05-OCT-92	750671	2085330	Kclst	5963.09	5965.17	21.73	11.00	20.48	5.80	5946.7
P208889	86.22	05-OCT-92	751086	2085249	Kaltclst	5947.30	5949.25	99.16	87.76	96.94	5.50	5863.0
P208989	17.55	05-OCT-92	751044	2084839	Kaltss & Kaltclst	5962.53	5964.56	28.12	15.40	24.84	3.50	5947.0
P209089	25.13	05-OCT-92	750566	2084910	Kaltclst	5972.16	5974.26	27.21	16.50	25.96	11.50	5949.1
P209189	13.5	05-OCT-92	750762	2084309	Kas & Kaltclst	5980.66	5982.21	36.08	13.30	35.01	10.30	5968.7
P209289	14.62	05-OCT-92	750863	2084139	Qrf	5981.59	5983.42	13.40	8.20	12.66	12.20	5968.8
P209389	18.42	05-OCT-92	750864	2084130	Kas & Kaltss & Kcss	5981.47	5983.39	30.05	16.82	28.80	13.80	5965.0
P209489	29.37	05-OCT-92	750991	2084634	Kas & Kaltss	5977.98	5980.10	36.25	15.48	35.00	9.00	5950.7
P209589	18.75	05-OCT-92	751071	2085286	Kaltclst & Kaclst	5948.17	5950.04	19.77	9.07	18.52	4.10	5931.3
P209689	28.37	05-OCT-92	750533	2085514	Kaltclst	5962.63	5964.43	27.93	17.20	26.67	12.20	5936.1
P209789	10.05	05-OCT-92	750579	2085481	Qrf	5962.82	5964.94	13.75	3.00	12.50	12.00	5954.9
P209889	5.34	05-OCT-92	751194	2084984	Kaltclst	5940.28	5942.40	19.63	8.89	18.33	3.90	5937.1

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water-Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/UTH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
P209989	DRY	02-OCT-92	751565	2084649	Qc	5898.10	5900.40	9.58	3.81	8.18	7.70	5900.4
P210089	18.6	05-OCT-92	751564	2084639	Kaltclst	5898.40	5900.40	22.93	12.20	21.50	7.20	5881.8
P210089	18.72	02-OCT-92	751564	2084639	Kaltclst	5898.40	5900.40	22.93	12.20	21.50	7.20	5881.7
P213689	9.47	01-OCT-92	749460	2083736	Qrf	5994.30	5996.04	14.80	9.08	13.50	13.00	5986.6
P213889	DRY	01-OCT-92	750466	2086109	Kss & Kcss	5954.10	5955.94	22.03	11.30	20.83	8.00	5955.9
P213989	DRY	01-OCT-92	750468	2086162	Qrf	5954.30	5956.38	7.20	3.29	6.92	6.70	5956.4
P215789	15.79	01-OCT-92	749470	2083430	Qrf	6002.00	6003.66	19.59	14.53	18.50	18.00	5987.9
P218089	9.49	05-OCT-92	749941	2084020	Qrf	5985.80	5987.55	8.69	3.00	7.43	6.00	5978.1
P218389	14.53	05-OCT-92	750831	2085648	Qrf	5956.20	5958.45	13.77	8.06	12.50	12.00	5943.9
P219189	9.8	05-OCT-92	751222	2084010	Qc	5941.20	5943.15	12.77	7.08	11.50	11.00	5933.4
P219489	13.46	05-OCT-92	750415	2085651	Qrf	5959.50	5961.15	24.20	18.48	22.90	22.50	5947.7
P219589	22.52	05-OCT-92	750268	2085536	Kclst & Kaclst	5963.80	5965.70	26.99	21.27	25.70	17.20	5943.2
P313589	9.32	01-OCT-92	748510	2083547	Qrf	6008.50	6010.11	13.76	8.08	12.50	11.00	6000.8
P314089	10.05	01-OCT-92	749461	2083653	Qrf	5998.70	5998.49	11.06	5.37	9.79	9.30	5988.4
P314289	13.33	01-OCT-92	748216	2083280	Qrf	6010.10	6011.77	14.80	9.11	13.51	13.00	5998.4
P320089	15.23	02-OCT-92	748799	2083280	Qrf	6009.90	6011.87	20.08	14.38	18.81	18.80	5996.6
P414189	10.87	01-OCT-92	749059	2082986	Qrf	6010.60	6012.18	19.78	14.09	18.50	18.00	6001.3
P415889	16.53	01-OCT-92	749125	2080718	Qrf	6050.40	6052.60	44.50	38.75	43.20	49.50	6036.1
P415989	9.05	01-OCT-92	749025	2081011	Qrf	6044.90	6046.71	28.00	22.30	26.73	34.00	6037.7
P416089	11.36	01-OCT-92	748605	2080720	Qrf	6051.70	6053.95	35.39	29.24	34.00	33.50	6042.6
P416189	11.54	01-OCT-92	748606	2081120	Qrf	6045.60	6047.95	30.94	25.23	29.66	29.20	6036.4
P416289	14.08	01-OCT-92	748598	2081555	Qrf	6038.60	6040.22	24.77	19.07	23.50	23.00	6026.1
P416389	16.48	01-OCT-92	748313	2080631	Qrf	6056.40	6057.14	31.40	25.69	30.10	30.00	6040.7
P416489	19.28	01-OCT-92	748210	2081113	Qrf	6048.50	6050.15	26.98	21.27	25.70	25.20	6030.9
P416589	27.73	01-OCT-92	748211	2081546	Qrf	6041.20	6042.81	32.10	27.04	31.00	30.50	6015.1
P416689	29.73	01-OCT-92	748147	2081941	Qrf	6035.00	6036.55	33.76	28.09	32.50	32.00	6006.8
P416789	27.53	01-OCT-92	748206	2082382	Qrf	6027.80	6029.27	28.80	22.48	26.90	26.40	6001.7
P416889	18.37	01-OCT-92	748206	2082815	Qrf	6017.40	6018.79	21.52	15.86	20.27	20.20	6000.4
P418289	10.42	02-OCT-92	748952	2082653	Qrf	6016.90	6018.20	26.70	9.60	23.50	23.00	6007.8
00191	20.25	02-OCT-92	749237	2086244	Qrf	5968.86	5970.44	0.00	15.00	25.00	24.20	5950.2
01391	12.99	01-OCT-92	749402	2085226	Qrf	5973.70	5975.30	16.00	6.00	14.00	14.50	5962.3
01491	16.21	01-OCT-92	749430	2085474	Kss & Kcs	5970.37	5972.03	26.00	14.00	24.00	1.60	5955.8
01791	15.21	01-OCT-92	749504	2086018	Kaltss & Kaclst	5965.78	5967.41	20.00	10.00	18.00	8.00	5952.2
01891	19.42	01-OCT-92	749438	2086023	Kaltss & Kaltclst	5971.76	5973.37	32.00	20.00	30.00	12.40	5954.0
02091	22.11	01-OCT-92	749617	2086428	Kaclst, Kaslt, Kaltclst	5965.19	5966.65	32.60	15.60	30.60	16.10	5944.5
02191	DRY	01-OCT-92	749708	2086166	Qrf	5965.81	5967.51	15.00	8.00	13.00	13.50	5967.5
02291	13.51	01-OCT-92	749880	2086139	Kaclst & Kcss	5936.66	5938.26	18.50	11.50	16.50	8.80	5924.8
2391	DRY	02-OCT-92	749853	2086600	Qrf	5956.82	5958.43	8.00	3.00	6.00	6.90	5958.4
02491	16.9	01-OCT-92	749949	2086432	Kaltss, Kaslt	5944.54	5946.21	18.80	11.80	16.80	8.50	5929.3
02691	8.81	01-OCT-92	750385	2086043	Kaltss & Kaltclst	5934.78	5936.38	18.00	6.00	16.00	1.10	5927.6

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water-Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
06591	20.01	02-OCT-92	749064	2085535	Kaclst & Kaltclst	5978.28	5979.78	50.00	33.00	48.00	15.40	5959.8
06691	22.02	02-OCT-92	749068	2085714	Qrf	5978.34	5979.94	25.10	13.10	23.10	22.00	5957.9
06791	22.85	02-OCT-92	748855	2085646	Qrf	5978.87	5980.38	23.20	11.20	21.20	21.20	5957.5
06891	16.18	02-OCT-92	749258	2085883	Qrf	5974.14	5975.62	16.00	6.00	14.00	14.00	5959.4
06991	20.99	02-OCT-92	749168	2085990	Qrf	5972.91	5974.57	31.00	14.00	29.00	28.60	5953.6
07191	21.21	02-OCT-92	748850	2085908	Qrf	5974.79	5976.34	23.10	11.10	21.10	20.00	5955.1
07291	22.12	02-OCT-92	748748	2085766	Qrf	5977.27	5978.80	22.60	10.60	20.60	20.00	5956.7
07391	7.88	02-OCT-92	748547	2085827	Qrf & Kclst	5949.14	5950.61	13.40	5.40	11.40	8.10	5942.7
08891	23.55	02-OCT-92	749128	2085966	Qrf	5976.36	5978.06	27.30	15.30	25.30	23.00	5954.5
09091	23.4	02-OCT-92	748918	2085943	Qrf	5975.16	5976.79	26.70	14.70	24.70	24.00	5953.4
09691	11.3	02-OCT-92	748572	2086038	Kaltss & Kclst	5935.64	5937.05	16.00	6.00	14.00	3.10	5925.8
12091	19.48	01-OCT-92	749436	2086069	Kaltss	5971.59	5973.27	24.00	14.00	22.00	13.20	5953.8
12291	16.3	01-OCT-92	749429	2085441	Kcss & kss	5970.98	5972.73	16.10	7.10	14.10	2.00	5956.4
13091	21.68	02-OCT-92	748960	2085992	Qrf	5973.68	5975.20	23.30	11.30	21.30	19.50	5953.5
13191	19.48	02-OCT-92	749071	2085530	Kaclst	5978.25	5979.90	27.70	15.70	25.70	15.40	5960.4
13291	DRY	02-OCT-92	749060	2085523	Qrf	5978.48	5979.97	17.70	5.70	15.70	15.40	5980.0
13291	DRY	01-OCT-92	749060	2085523	Qrf	5978.48	5979.97	17.70	5.70	15.70	15.40	5980.0
33491	10.91	01-OCT-92	748080	2084883	Qc & Kaclst	5926.06	5928.59	11.10	6.68	8.69	8.00	5917.7
33691	10.31	01-OCT-92	748112	2084994	Qc	5926.99	5929.24	10.60	6.19	8.11	7.80	5918.9
33891	10.6	01-OCT-92	747961	2084641	Qc & Kclst	5927.54	5929.94	11.10	6.70	8.70	8.10	5919.3
34591	13.61	02-OCT-92	748462	2085621	Qc & Kclst	5952.19	5954.63	11.30	6.90	8.90	8.20	5941.0
34791	6.41	02-OCT-92	748377	2085521	Qc	5957.39	5953.81	10.42	6.00	8.00	8.00	5947.5
35391	12.49	01-OCT-92	748011	2083907	Kclst	5960.73	5963.03	10.50	6.10	8.11	6.00	5950.5
35991	17.24	01-OCT-92	748057	2083756	Qc	5973.25	5976.46	16.10	8.68	13.70	12.20	5959.2
36191	10.37	01-OCT-92	748091	2084198	Qc	5962.89	5965.17	17.00	9.52	14.60	14.00	5954.8
36391	26.09	01-OCT-92	748042	2084294	Qrf	5984.57	5967.01	29.80	17.43	27.41	26.40	5940.9
36691	25.83	01-OCT-92	748027	2084421	Qc	5949.76	5961.52	27.83	15.83	25.83	25.00	5925.7
37191	9.59	01-OCT-92	748036	2084533	Qc	5945.91	5948.29	23.07	11.12	21.07	20.50	5938.7
37591	9.73	01-OCT-92	748580	2084610	Qrf	5991.42	5993.45	14.60	7.60	12.60	12.00	5983.7
37691	DRY	01-OCT-92	748692	2085217	Qrf	5984.46	5985.24	18.50	6.51	16.50	16.20	5985.2
37891	40.8	01-OCT-92	748075	2084915	Kcsltst & Kaltst	5925.22	5926.29	55.20	43.20	53.20	4.70	5885.5
37991	47.77	01-OCT-92	748063	2084731	Kcsltst & Kssltst	5931.45	5933.55	57.20	45.20	55.20	6.90	5885.8
38191	11.19	01-OCT-92	748014	2084765	Qc	5924.47	5926.40	17.00	10.00	15.00	14.70	5915.2
38291	12.71	01-OCT-92	748032	2084801	Qc	5924.49	5926.71	10.70	6.70	8.70	8.40	5914.0
39691	12.88	01-OCT-92	748357	2083634	Qrf & Kclst	6006.26	6008.37	11.00	7.00	9.00	8.00	5995.5

SUPPLEMENTAL FALL 1992 DATA:

2186	33.86	06-OCT-92	750855	2082501	Kss & Kaltclst	6004.76	6005.98	67.25	35.00	67.24	15.00	5972.1

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water–Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
2286	10.03	06–OCT–92	750718	2084411	Qrf	5978.77	5979.55	11.20	3.20	11.20	11.00	5969.5
2386	87.75	06–OCT–92	750338	2084259	Kslt & Ksltclst	5982.46	5982.46	117.25	113.00	117.25	8.20	5894.7
5687	8.5	06–OCT–92	750638	2084423	Qrf	5978.39	5979.77	9.92	3.52	9.67	9.40	5971.3
B208189	22.72	06–OCT–92	751138	2085885	Kclst	5935.40	5937.46	27.58	16.90	26.34	11.00	5914.7
P218089	9.49	06–OCT–92	749941	2084020	Qrf	5985.80	5987.55	8.69	3.00	7.43	6.00	5978.1
P419689	20.04	06–OCT–92	748522	2082513	Qrf & Kss	6022.40	6023.42	24.77	19.08	23.50	22.00	6003.4
1986	3.07	07–OCT–92	750894	2085296	Kclst	5943.08	5943.86	12.25	3.00	12.25	11.50	5940.8
2486	DRY	07–OCT–92	750338	2084277	Qrf	5982.45	5983.56	7.45	2.95	7.45	7.20	5983.6
2986	DRY	07–OCT–92	750599	2085687	Qrf	5959.58	5960.68	8.77	2.83	8.77	8.50	5960.7
P207989	18.35	07–OCT–92	750671	2085330	Kclst	5963.09	5965.17	21.73	11.00	20.48	5.80	5946.8
P209289	14.58	07–OCT–92	750863	2084139	Qrf	5981.59	5983.42	13.40	8.20	12.66	12.20	5968.8
P209389	18.4	07–OCT–92	750864	2084130	Kss & Kslts & Kcss	5981.47	5983.39	30.05	16.82	28.80	13.80	5965.0
3086	7.36	08–OCT–92	751078	2084921	Kclst	5957.42	5958.39	14.93	2.48	14.93	2.50	5951.0
3286	53.91	08–OCT–92	751050	2084743	Kss & Kslts	5966.08	5967.92	125.50	114.90	125.50	1.00	5914.0
P207789	29.14	08–OCT–92	750392	2085343	Kslt/clst	5965.88	5967.75	28.63	17.90	27.34	12.90	5938.6
P208989	17.55	08–OCT–92	751044	2084839	Kslts & Kslt/clst	5962.53	5964.56	26.12	15.40	24.84	3.50	5947.0
P209089	25	08–OCT–92	750566	2084910	Kslt/clst	5972.16	5974.25	27.21	16.50	25.96	11.50	5949.3
P209889	5.34	08–OCT–92	751194	2084984	Kslt/clst	5940.28	5942.40	19.63	8.89	18.33	3.90	5937.1
36991	DRY	09–OCT–92	748180	2084177	Qrf & Kclst	5969.48	5972.31	10.62	6.62	8.62	8.00	5972.3
37791	18.86	09–OCT–92	748592	2083753	Qrf	6002.16	6004.18	22.60	10.60	20.60	20.00	5985.3
5187	15.57	09–OCT–92	748103	2083850	fill?	5963.27	5965.22	14.00	3.58	13.84	12.50	5949.7
5287	10.42	09–OCT–92	748145	2084067	fill?	5967.85	5969.57	20.50	3.50	20.25	20.00	5959.2
6186	10.74	09–OCT–92	749198	2083717	Qrf	5999.47	6000.60	12.25	5.00	12.00	11.50	5989.9
P207689	8.77	09–OCT–92	750398	2085318	Qrf	5966.32	5967.88	14.36	3.64	13.10	12.60	5959.1
P317989	9.68	09–OCT–92	748891	2084272	Qrf	5990.90	5992.84	8.73	3.00	7.49	6.40	5983.2
2187	7.84	12–OCT–92	749969	2085799	Qc	5928.43	5929.69	10.56	3.26	10.41	8.00	5921.9
2287	80.57	12–OCT–92	749924	2085822	Kss & Kslt	5931.18	5932.80	88.70	81.41	88.46	12.80	5852.2
2586	28.66	12–OCT–92	750412	2084831	Kslt/clst & Kclst	5975.24	5977.14	82.00	59.90	82.00	8.00	5948.5
2686	12.08	12–OCT–92	750411	2084841	Qrf	5975.42	5977.17	11.00	3.75	11.00	10.50	5965.1
37791	18.86	12–OCT–92	748592	2083753	Qrf	6002.16	6004.18	22.60	10.60	20.60	20.00	5985.3
5187	15.57	12–OCT–92	748103	2083850	fill?	5963.27	5965.22	14.00	3.58	13.84	12.50	5949.7
6186	10.74	12–OCT–92	749198	2083717	Qrf	5999.47	6000.60	12.25	5.00	12.00	11.50	5989.9
P207589	25.49	12–OCT–92	750395	2084843	Kslt/clst	5974.06	5975.96	25.10	14.40	23.86	9.40	5950.5
P207889	10.09	12–OCT–92	750671	2085343	Qrf	5962.82	5964.90	8.95	3.26	7.70	8.50	5954.8
P209689	28.29	12–OCT–92	750533	2085514	Kslt/clst	5962.63	5964.43	27.93	17.20	26.67	12.20	5936.1
P209189	13.78	13–OCT–92	750762	2084309	Kss & Kslt/clst	5980.66	5982.21	36.08	13.30	35.01	10.30	5968.4
P317989	9.68	13–OCT–92	748891	2084272	Qrf	5990.90	5992.84	8.73	3.00	7.49	6.40	5983.2
5287	10.42	14–OCT–92	748145	2084067	fill?	5967.85	5969.57	20.50	3.50	20.25	20.00	5959.2
P209489	29.44	14–OCT–92	750991	2084634	Kss & Kslts	5977.98	5980.10	36.25	15.48	35.00	9.00	5950.7
2786	73.33	15–OCT–92	750781	2085238	Kslts & Kclst	5962.89	5963.88	133.00	128.50	133.00	11.00	5890.6

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water-Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE
P209789	10.27	16-OCT-92	750579	2085481	Qrf	5962.82	5964.94	13.75	3.00	12.50	12.00	5954.7
3787	9.8	19-OCT-92	750494	2085224	Qrf	5967.52	5968.99	9.00	3.50	8.77	8.00	5959.2
3887	11.37	19-OCT-92	750396	2085094	Qrf	5972.15	5973.90	9.50	3.50	9.27	7.80	5962.5
P416289	15.37	19-OCT-92	748598	2081555	Qrf	6038.60	6040.22	24.77	19.07	23.50	23.00	6024.9
P416289	11.23	19-OCT-92	748952	2082653	Qrf	6016.90	6018.20	26.70	9.60	23.50	23.00	6007.0
P419689	20.3	19-OCT-92	748522	2082513	Qrf & Kse	6022.40	6023.42	24.77	19.08	23.50	22.00	6003.1
0587	45.11	21-OCT-92	748081	2084549	Kse & Kaltse	5927.85	5929.99	51.50	42.00	51.25	11.00	5884.9
4486	8.68	21-OCT-92	749254	2082234	Qrf	6019.93	6021.96	26.25	3.23	26.25	25.50	6013.3
36391	26.17	23-OCT-92	748042	2084294	Qrf	5964.57	5967.01	29.80	17.43	27.41	26.40	5940.8
33491	10.75	26-OCT-92	748080	2084883	Qc & Kaclst	5926.06	5928.59	11.10	6.68	8.69	8.00	5917.8
33891	10.79	26-OCT-92	747961	2084841	Qc & Kclst	5927.54	5929.94	11.10	6.70	8.70	8.10	5919.2
35391	12.36	26-OCT-92	748011	2083967	Kclst	5960.73	5963.03	10.50	6.10	8.11	6.00	5950.7
36191	8.3	26-OCT-92	748091	2084198	Qc	5962.89	5965.17	17.00	9.52	14.60	14.00	5956.9
36691	25.04	26-OCT-92	748027	2084421	Qc	5949.76	5951.52	27.83	15.83	25.83	25.00	5926.5
37991	48.26	26-OCT-92	748063	2084731	Kcaltst & Kaaltst	5931.45	5933.55	57.20	45.20	55.20	6.90	5885.3
0187	10.27	27-OCT-92	748127	2083853	fill	5992.49	5994.08	12.08	3.38	11.83	11.80	5983.8
4387	9.31	27-OCT-92	748030	2084788	Qc	5928.08	5926.41	12.50	3.50	12.25	12.00	5917.1
37591	10.47	28-OCT-92	748580	2084610	Qrf	5991.42	5993.45	14.60	7.60	12.60	12.00	5983.0
P320089	15.71	28-OCT-92	748799	2083280	Qrf	6008.90	6011.87	20.08	14.38	18.81	18.80	5996.2
02291	14.15	29-OCT-92	749880	2086139	Kaclst & Kcse	5966.68	5938.26	18.50	11.50	16.50	8.80	5924.1
37891	41.61	29-OCT-92	748075	2084915	Kcaltst & Kaltst	5925.22	5926.29	55.20	43.20	53.20	4.70	5884.7
4587	90.68	29-OCT-92	748313	2085451	Kse & Kalt & Kclst	5949.32	5950.94	101.30	89.50	97.05	4.00	5860.2
13591	DRY	02-OCT-92	749204	2086612	Qrf	5965.92	5967.55	18.00	6.00	16.00	16.00	5967.6
1386	8.67	12-OCT-92	751857	2086051	Qc	5840.47	5842.50	9.50	3.09	9.50	9.00	5833.9
1486	10.8	12-OCT-92	751856	2085838	Kse & Kaclst	5844.71	5846.71	55.36	39.42	55.36	11.00	5835.9
1586	7.08	07-OCT-92	751852	2085812	Qc	5848.43	5850.63	14.44	4.09	14.44	12.50	5843.6
1686	6.54	12-OCT-92	751747	2085260	Kaltse	5867.92	5869.56	45.06	39.06	45.06	7.00	5863.0
1786	8.54	07-OCT-92	751740	2085242	Qc	5868.43	5869.57	13.98	3.73	13.98	12.50	5861.0
37791	18.86	09-OCT-92	748592	2083753	Qrf	6002.16	6004.18	22.60	10.60	20.60	20.00	5985.3
37791	18.86	12-OCT-92	748592	2083753	Qrf	6002.16	6004.18	22.60	10.60	20.60	20.00	5985.3
B208689	13.74	12-OCT-92	751728	2085250	Kaltclst	5867.60	5869.60	23.07	12.32	21.80	7.30	5855.9
B208789	9.79	05-OCT-92	751755	2084450	Qc	5907.10	5909.09	12.32	2.88	10.93	8.40	5899.2
B208289	17.32	05-OCT-92	751739	2086289	Kaltclst & Kclst	5850.70	5852.95	16.16	5.95	15.42	0.20	5835.6
B210489	8.23	08-OCT-92	751802	2085513	Qc	5856.40	5858.71	8.67	2.98	7.41	7.00	5850.5

APPENDIX 4.1
Industrial Area IM/IRA/DD
Water–Level Measurements in Industrial Area Monitoring Wells, Spring and Fall 1992

WELL	DTW	DATE	STATE NORTH	STATE EAST	COMPLETION UNIT/LITH	SURFACE ELEV.	TOP OF CASING	TD CSG	TOP SCRN	BOT SCRN	TOP OF BEDROCK	WLE

INDEX:

SURFACE ELEV. = elevation of land surface at well head, in feet above mean sea level

STATE NORTH = State plane coordinates, northing

STATE EAST = State plane coordinates, easting

COMPLETION UNIT/LITH = rock type in which well is screened:

- Kss = Cretaceous sandstone
- Kclst = Cretaceous claystone
- Kcslt = Cretaceous clayey siltstone
- Kcss = Cretaceous clayey sandstone
- Kscist = Cretaceous sandy claystone
- Kslt = Cretaceous siltstone
- Ksltclst = Cretaceous silty claystone
- Kslss = Cretaceous silty sandstone
- Kssit = Cretaceous sandy siltstone
- Qa = Quaternary alluvium
- Qc = Quaternary colluvium
- Qrf = Quaternary Rocky Flats Alluvium

DTW = depth to water, measured in feet from top of casing.

TD CSG = total depth of casing, in feet below ground surface.

TOP SCRN = depth to top of well screen, in feet below ground surface.

BOT SCRN = depth to bottom of well screen, in feet below ground surface.

WLE = water–level elevation, in feet above mean sea level

(intentionally blank)

APPENDIX 4.2

HISTORICAL GROUNDWATER MONITORING RESULTS FOR 1989

INDUSTRIAL AREA PIEZOMETERS

VOLATILE ORGANIC COMPOUNDS

(intentionally blank)

APPENDIX 4.2
Industrial Area IM/IRA/DD
Historical Groundwater Monitoring Results for 1989 Industrial Area Piezomenters, VOCs

Well ID	B208089	B208189	P207489	P207589	P207689	P207789	P207889	P207989	P208889	P208989	P209089	P209189
Date	10-14-91	10-8-91	10-21-91	7-19-90	10-9-91	12-12-90	7-11-91	10-9-91	10-7-91	3-24-91	3-26-91	10-10-91
Analytes												
1,1,1-TRICHLOROETHANE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
1,1,2,2-TETRACHLOROETHANE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
1,1,2-TRICHLOROETHANE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
1,1-DICHLOROETHANE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
1,1-DICHLOROETHENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
1,2-DICHLOROETHANE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 5	< 5	< 5	< 5
1,2-DICHLOROETHENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
1,2-DICHLOROPROPANE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
2-BUTANONE	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
4-METHYL-2-PENTANONE	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
ACETONE	< 10	< 10	< 10	< 10	< 10	36	< 10	< 10	< 10	11	13	< 10
BENZENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
BROMODICHLOROMETHANE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
BROMOFORM	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
BROMOMETHANE	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
CARBON DISULFIDE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
CARBON TETRACHLORIDE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
CHLOROBENZENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
CHLOROETHANE	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
CHLOROFORM	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
CHLOROMETHANE	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
cis-1,3-DICHLOROPROPENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
DIBROMOCHLOROMETHANE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
ETHYLBENZENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
METHYLENE CHLORIDE	< 5	< 5	< 7	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
STYRENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
TETRACHLOROETHENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
TOLUENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
TOTAL XYLENES	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
trans-1,3-DICHLOROPROPENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
TRICHLOROETHENE	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
VINYL ACETATE	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
VINYL CHLORIDE	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
2-HEXANONE	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10

All values express in micrograms per liter.
The "<" symbol designates the analyte concentration is below the detection limit of the analysis.
VOCs = Volatile Organic Compounds

APPENDIX 4.2
Industrial Area IM/IRA/DD
Historical Groundwater Monitoring Results for 1989 Industrial Area Piezomenters, VOCs

Well ID / Date	P209289 5-29-91	P209389 10-8-91	P209489 10-16-91	P209589 10-4-91	P209789 10-11-91	P320089 10-22-91
Analytes						
1,1,1-TRICHLOROETHANE	< 5	< 5	< 5	< 5	< 5	< 5
1,1,2,2-TETRACHLOROETHANE	< 5	< 5	< 5	< 5	< 5	< 5
1,1,2-TRICHLOROETHANE	< 5	< 5	< 5	< 5	< 5	< 5
1,1-DICHLOROETHANE	< 5	< 5	< 5	< 5	< 5	< 5
1,1-DICHLOROETHENE	10	83	< 5	< 5	< 5	< 5
1,2-DICHLOROETHANE	< 5	< 5	< 5	< 5	< 5	< 5
1,2-DICHLOROETHENE	< 5	< 5	< 5	< 5	< 5	< 5
1,2-DICHLOROPROPANE	< 5	< 5	< 5	< 5	< 5	50
2-BUTANONE	20	< 10	< 10	< 10	< 10	100
4-METHYL-2-PENTANONE	20	< 10	< 10	< 10	< 10	< 10
ACETONE	< 10	< 10	< 10	< 10	< 10	150
BENZENE	< 5	< 5	< 5	< 5	< 5	< 5
BROMODICHLOROMETHANE	< 5	< 5	< 5	< 5	< 5	< 5
BROMOFORM	10	< 5	< 5	< 5	< 5	< 5
BROMOMETHANE	20	< 10	< 10	< 10	< 10	< 10
CARBON DISULFIDE	10	< 5	< 5	< 5	< 5	< 5
CARBON TETRACHLORIDE	330	25	49	< 5	< 5	< 5
CHLOROBENZENE	< 5	< 5	< 5	< 5	< 5	< 5
CHLOROETHANE	< 10	< 10	< 10	< 10	< 10	< 10
CHLOROFORM	100	7	18	< 5	< 5	< 5
CHLOROMETHANE	< 10	< 10	< 10	< 10	< 10	< 10
cis-1,3-DICHLOROPROPENE	< 5	< 5	< 5	< 5	< 5	< 5
DIBROMOCHLOROMETHANE	< 5	< 5	< 5	< 5	< 5	< 5
ETHYLBENZENE	< 5	< 5	< 5	< 5	< 5	< 5
METHYLENE CHLORIDE	< 5	< 5	< 5	< 5	< 5	26
STYRENE	< 5	< 5	< 5	< 5	< 5	50
TETRACHLOROETHENE	< 5	< 5	< 5	< 5	< 5	< 5
TOLUENE	< 5	< 5	< 5	< 5	< 5	< 5
TOTAL XYLENES	< 5	< 5	< 5	< 5	< 5	< 5
trans-1,3-DICHLOROPROPENE	< 5	< 5	< 5	< 5	< 5	< 5
TRICHLOROETHENE	< 5	< 5	57	< 5	< 5	< 5
VINYL ACETATE	< 10	< 10	< 10	< 10	< 10	50
VINYL CHLORIDE	< 10	< 10	< 10	< 10	< 10	150
2-HEXANONE	20	< 10	< 10	< 10	< 10	< 10

All values express in micrograms per liter.
The "<" symbol designates the analyte concentration is below the detection limit of the analysis.
VOCs = Volatile Organic Compounds

APPENDIX 4.3

HISTORICAL GROUNDWATER MONITORING RESULTS FOR 1989 INDUSTRIAL AREA PIEZOMETERS, SELECTED METALS

(intentionally blank)

APPENDIX 4.3
Industrial Area IM/IRA/DD
Historical Groundwater Monitoring Results for 1989 Industrial Area Piezometers, Selected Metals

Well ID	P209789	P209889	P210089	P210289	P320089	P418289
Date	11-21-91	11-21-91	11-21-91	9-17-90	10-22-91	11-11-91
Analyte						
BERYLLIUM	< 5	10	< 5	< 5	< 5	< 5
CADMIUM	< 5	42.8	8.8	< 5	NR	< 5
CHROMIUM	15.1	178	34	< 10	16	16.4
CYANIDE	NR	NR	NR	NR	5	NR
MERCURY	< .2	0.25	< 0.2	0.38	< 0.2	1.6
STRONTIUM	1020	24800	4650	2180	333	622

All values expressed in micrograms per liter.
NR = Not Reported
The "<" symbol designates the analyte concentration is below the detection limit of the analysis.

(intentionally blank)

APPENDIX 4.4
HISTORICAL GROUNDWATER MONITORING RESULTS, INDUSTRIAL AREA PIEZOMETERS, RADIONUCLIDES

(intentionally blank)

APPENDIX 4.4
Industrial Area IM/IRA/DD
Historical Groundwater Monitoring Results for 1989 Industrial Area Piezometers, Radionuclides

Well ID Date	P208089 10-8-91	P208189 10-8-91	P207389 10-21-91	P207489 10-21-91	P207589 3-27-91	P207689 10-9-91	P207789 8-7-91
RADIONUCLIDES:							
AMERICIUM-241	NA	NA	0.003602 ± 0.00418	NA	NA	0.001268 ± 0.00254	NA
CESIUM-137	NA	NA	NA	NA	NA	0.586 ± 0.466	NA
GROSS ALPHA	8.6 ± 3.96	18.06 ± 6.5	NA	2.328 ± 1.36	NA	NA	NA
GROSS ALPHA-DISSOLVED	NA	NA	5.571 ± 2.91	NA	NA	8.254 ± 5.7	NA
GROSS ALPHA-SUSPENDED	NA	NA	NA	NA	NA	NA	NA
GROSS BETA	5.135 ± 2.33	12.78 ± 2.99	NA	2.587 ± 1.49	NA	NA	NA
GROSS BETA-DISSOLVED	NA	NA	5.634 ± 1.83	NA	NA	13.45 ± 4.88	NA
GROSS BETA-SUSPENDED	NA	NA	NA	NA	NA	NA	NA
PLUTONIUM-238	NA	NA	NA	NA	NA	NA	NA
PLUTONIUM-239	NA	NA	NA	NA	NA	NA	NA
PLUTONIUM-239/240	NA	NA	0.0007436 ± 0.00205	NA	NA	0 ± 0.00285	NA
RADIUM-226	NA	NA	0.8664 ± 0.203	NA	NA	0.5205 ± 0.168	NA
RADIUM-228	NA	NA	NA	NA	NA	NA	NA
STRONTIUM-89,90	NA	NA	0.06796 ± 0.206	NA	NA	0.2575 ± 0.248	NA
TRITIUM	424 ± 231	376.5 ± 228	294.3 ± 235	NA	67.5 ± 191	223.7 ± 239	69.63 ± 199
URANIUM-233,-234	3.328 ± 0.972	14.87 ± 2.7	4.275 ± 1.38	2.173 ± 0.848	NA	10.22 ± 1.86	NA
URANIUM-235	NA	0.2287 ± 0.236	-0.0174 ± 0.035	0 ± 0.213	NA	0.1818 ± 0.183	NA
URANIUM-238	2.832 ± 0.882	6.818 ± 1.55	-2.355 ± 0.973	1.885 ± 0.785	NA	8.225 ± 1.59	NA

NA = Not Analyzed.
All results in picocuries per liter.
± Indicates error within two standard deviation.

APPENDIX 4.4
Industrial Area IM/IRA/DD
Historical Groundwater Monitoring Results for 1989 Industrial Area Piezometers, Radionuclides

Well ID Date	P207889 10-9-91	P207989 10-9-91	P208889 6-7-91	P208989 10-10-89	P209089 3-26-91	P209189 10-10-91	P209389 10-8-91
RADIONUCLIDES:							
AMERICIUM-241	0.00592 ± 0.00533	NA	NA	0.00246 ± 0.00349	NA	0.09905 ± 0.0244	0.00646 ± 0.00527
CESIUM-137	0.1105 ± 0.486	NA	NA	NA	NA	NA	NA
GROSS ALPHA	26.02 ± 10.2	NA	NA	NA	NA	NA	2.165 ± 1.34
GROSS ALPHA-DISSOLVED	NA	NA	6.102 ± 5.43	113.2 ± 43	4.721 ± 1.61	4.156 ± 2.29	NA
GROSS ALPHA-SUSPENDED	NA	NA	NA	NA	NA	NA	NA
GROSS BETA	10.9 ± 3.59	NA	NA	NA	NA	NA	2.636 ± 1.61
GROSS BETA-DISSOLVED	NA	NA	5.99 ± 2.58	73.66 ± 24.8	7.243 ± 1.51	26.64 ± 3.61	NA
GROSS BETA-SUSPENDED	NA	NA	NA	NA	NA	NA	NA
PLUTONIUM-238	NA	NA	NA	NA	NA	NA	NA
PLUTONIUM-239	NA	NA	NA	NA	NA	NA	NA
PLUTONIUM-239/240	0.003804 ± 0.00411	NA	NA	0.002971 ± 0.00444	NA	0.442 ± 0.0599	0.003995 ± 0.00465
RADIUM-226	NA	NA	NA	NA	NA	NA	NA
RADIUM-228	NA	NA	NA	NA	NA	NA	NA
STRONTIUM-89,90	0.1764 ± 0.198	NA	NA	0.1373 ± 0.233	NA	0.06864 ± 0.21	0.1514 ± 0.201
TRITIUM	NA	111.6 ± 214	207.2 ± 188	1941 ± 329	-30.9 ± 186	258.5 ± 241	642.1 ± 24.3
URANIUM-233,-234	12.89 ± 2.43	NA	1.314 ± 0.532	63.85 ± 8.56	27.06 ± 4.33	4.337 ± 1.05	0.182 ± 0.209
URANIUM-235	0.4088 ± 0.339	NA	0 ± 0.146	1.259 ± 0.803	0.6165 ± 0.388	0.2688 ± 0.231	0.089099 ± 0.098
URANIUM-238	9.729 ± 1.99	NA	0.3329 ± 0.261	36.49 ± 5.17	17.57 ± 3.06	4.749 ± 1.11	0.1092 ± 0.19

NA = Not Analyzed.
All results in picocuries per liter.
± Indicates error within two standard deviation.

APPENDIX 4.4
Industrial Area IM/IRA/DD
Historical Groundwater Monitoring Results for 1989 Industrial Area Piezometers, Radionuclides

Well ID Date	P209489 10-16-91	P209589 10-4-91	P209789 10-11-91	P209889 10-15-91	P210089 10-9-91	P210289 3-26-91	P218089 8-26-91
RADIONUCLIDES:							
AMERICIUM-241	0.017 ± 0.009	NA	0.00217 ± 0.00308	0.0081 ± 0.0065	NA	NA	NA
CESIUM-137	0.1203 ± 0.492	NA	NA	0.1048 ± 0.531	NA	NA	NA
GROSS ALPHA	60.99 ± 20.4	NA	NA	75.05 ± 53.6	NA	NA	NA
GROSS ALPHA-DISSOLVED	NA	NA	5.743 ± 3.64	NA	3.989 ± 4.38	67.82 ± 23.9	NA
GROSS ALPHA-SUSPENDED	NA	NA	NA	NA	NA	NA	NA
GROSS BETA	109.7 ± 13.9	NA	NA	85.02 ± 35.6	NA	NA	NA
GROSS BETA-DISSOLVED	NA	NA	3.863 ± 2.38	NA	17.44 ± 8.12	36.15 ± 8.73	NA
GROSS BETA-SUSPENDED	NA	NA	NA	NA	NA	NA	NA
PLUTONIUM-238	NA	NA	NA	NA	NA	NA	NA
PLUTONIUM-239	NA	NA	NA	NA	NA	NA	NA
PLUTONIUM-239/240	-0.000259 ± 0.0051	NA	0.001967 ± 0.00279	0.0027 ± 0.0038	NA	NA	NA
RADIUM-226	0.4023 ± 0.14	NA	0.3957 ± 0.124	1.058 ± 0.72	NA	NA	NA
RADIUM-228	NA	NA	NA	8.508 ± 2.22	NA	NA	NA
STRONTIUM-89,90	0.08788 ± 0.198	NA	0.4195 ± 0.279	0.4468 ± 0.287	NA	NA	NA
TRITIUM	1030 ± 271	13350 ± 1150	576.1 ± 259	6492 ± 642	13.56 ± 228	152.4 ± 196	383.3 ± 210
URANIUM-233,-234	31.28 ± 5.79	NA	4.321 ± 1.02	37.49 ± 5.28	2.906 ± 0.829	49.31 ± 8.15	NA
URANIUM-235	1.3738 ± 0.756	NA	0.2191 ± 0.198	0.8506 ± 0.4224	0.09547 ± 0.136	1.94 ± 0.838	NA
URANIUM-238	28.564 ± 5.38	NA	3.62 ± 0.913	27.5 ± 4.04	2.482 ± 0.754	41.19 ± 6.96	NA

NA = Not Analyzed.
All results in picocuries per liter.
± Indicates error within two standard deviation.

(intentionally blank)

5.0 SURFACE WATER MONITORING

Surface water monitoring at RFP emphasizes compliance with all regulatory requirements and assures that water discharged from the terminal ponds is of high quality. These two objectives have been reinforced by strengthening the NPDES permit for the facility with a Federal Facility Compliance Agreement (FFCA) between EPA and DOE in 1991 and by the AIP between the State of Colorado and DOE in 1989. In addition to other requirements, the FFCA added requirements for sanitary waste discharges. Although the AIP is not enforceable and involves more than compliance, it strengthened existing agreements by allowing the state to sample and analyze terminal pond waters before discharge to assure water quality requirements were being met. In this agreement, DOE agreed to analyze pond water for radionuclides (as well as other constituents), which are solely regulated by DOE.

Surface water management efforts have been very successful in meeting the objectives of regulatory compliance and assuring high quality discharges from the terminal ponds. However, less monitoring has been performed in the Industrial Area because there was no regulatory requirement that would have justified the additional budget needed for a more complete program. As a result, program limitations that do not allow the objectives of this IM/IRA to be met are also present.

5.1 APPROACH

The current surface water monitoring program at RFP was assessed by identifying and inventorying the existing surface water monitoring programs and documents. The document identification process included interviewing EG&G Surface Water Division personnel and OU managers, and performing library searches. More than 30 major surface water documents were reviewed and evaluated for their pertinence to the Industrial Area IM/IRA. In general, documents reviewed included background characterization reports, base flow and storm water characterization reports, innovative

and/or experimental monitoring programs, OU-related monitoring programs, and regulatory monitoring programs. After review of these documents and programs, several sources were selected for more intensive review because of their data quality, proximity to the Industrial Area, inclusiveness, usability, up-to-date status, and/or accurate description of the current monitoring program. The following documents were determined to be of primary interest to the Industrial Area and are discussed in Sections 5.2 and 5.3:

- *Event-related Surface Water Monitoring Report for the Rocky Flats Plant for Water Years 1991 and 1992* (EG&G 1993k);
- *Final Surface Water Interim Measures/Interim Remedial Action Plan/Environmental Assessment and Decision Document, South Walnut Creek Basin, Operable Unit No. 2* (DOE 1992b);
- *Final Proposed Interim Measures/Interim Remedial Action Plan Decision Document for the Solar Evaporation Ponds, Operable Unit No. 4* (DOE 1992c);
- Rocky Flats Plant 1992 NPDES Permit Application (DOE 1992d);
- *Rocky Flats Plant Surface-Water and Sediment Monitoring Program Summary* (EG&G 1993l)
- *Storm Water NPDES Permit Application Monitoring Program, Rocky Flats Plant Site* (ASI 1993);
- *Draft Surface Water Management Plan* (EG&G 1992i);
- *1989 Surface-Water and Sediment Geochemical Characterization Report* (EG&G 1992j); and

- *1990 Surface-Water and Sediment Geochemical Characterization Report* (EG&G 1992k).

These documents were used to assess pathways of contaminants in surface water, evaluate data needs and monitoring gaps, assess monitoring alternatives, and make recommendations to improve the surface water monitoring programs within the Industrial Area.

In some cases, the projects described in these reports were limited in scope and designed to meet specific goals. For example, the storm water monitoring was designed specifically to respond to requirements imposed by the regulators for preparing a storm water permit applications. Technical review indicates data gaps with regard to the objectives of this IM/IRA even though the monitoring program successfully met the objectives established by the regulatory requirements for the storm water permit application.

The sections that follow present descriptions of monitoring programs that are pertinent to the IM/IRA, data gaps for the purposes of the IM/IRA that are created by scope limitations described above, and recommendations for future monitoring.

5.2 EXISTING MONITORING PROGRAMS

The RFP surface water and sediment monitoring program consists of compliance, operational, and characterization monitoring programs. The details of the monitoring program have changed over the past five years in response to regulatory changes and the need to increase program efficiency. For example, the monitoring programs were expanded during 1989 and 1990 to respond to data-collection needs for CERCLA, RCRA, DOE orders, and Best Management Practice (BMP) requirements. In 1991 and 1992, surface water monitoring programs were evaluated by EG&G for programmatic

efficiency, cost-effectiveness, and technical value. As a result, a variety of programs were eliminated or streamlined for reasons including cost reduction, enhanced performance efficiency, completion of data collection for programs such as the Background Geochemical Characterization program and the NPDES storm water discharge permit application, and lack of contamination detection at many monitoring locations (EG&G 1992l; EG&G 1993l).

As of January 1994, the surface water monitoring system includes (1) all compliance-related monitoring activities including those required by NPDES/FFCA and AIP; (2) operational monitoring under DOE orders; and (3) other activities including the Event-related Monitoring Program, Pond Effluent Treatment Research, and various nonroutine support activities involving water and sediment sampling (EG&G 1993l). See Appendix 5.1, Tables A through D, for sampling locations, analytes, and frequency for these programs.

Many of these monitoring activities focus on the A-, B-, and C-series detention ponds and are not directly pertinent to the Industrial Area IM/IRA; thus, subsequent discussion focuses on the NPDES storm water monitoring locations, the ongoing Event-Related Surface Water Monitoring Program, and STP monitoring program. These programs monitor stations closer to the Industrial Area boundary or within the Industrial Area.

5.2.1 NPDES Storm Water Permit Application Monitoring

The surface water stations that monitor the majority of the runoff from the Industrial Area (including footing drain discharges) are the six NPDES storm water monitoring locations shown in Figure 5-1 designated by "SW." (Note: SW023 is co-located with gaging station GS10.) Table 5-1 shows the total drainage area captured by each of the NPDES stations as well as the percentage of each drainage within the Industrial Area. These stations monitor runoff from all but 7 acres of the Industrial Area. With the

TABLE 5-1
Industrial Area IM/IRA/DD
NPDES Storm Water Monitoring Locations

Location	Description	Total Drainage Area (acres)	Industrial Area Drainage Area (acres)	Industrial Area % of Total Area
SW022	Concrete Diversion Box at East Patrol Road	84.5	84.5	100
SW023 (GS10)	South Walnut Creek at the STP	175.4	175.4	100
SW027	South Interceptor Canal at Woman Creek	166	34	18
SW093	North Walnut Creek Downstream from a 72-inch CMP	212.3	131	~62
SW118*	North Walnut Creek Upstream from 72-inch CMP at Drop Structure	50.4	24.8	~49
SW998** "back-ground"	CMP Culverts in West Interceptor Canal	205	20	10

Notes: CMP = corrugated metal pipe
STP = sewage treatment plant

Source: Data from the *Rocky Flats Plant Drainage and Flood Control Master Plan* (Wright Water Engineers 1992)

* It should be noted that the location of SW118 is wrong on many maps, including the ASI NPDES permit application report.

** The IM/IRA value differs from the ASI NPDES Permit application.

exception of SW023 and SW027, these stations have not been monitored since October 1992 because they were primarily used to collect data for the NPDES storm water permit that has been completed and is currently under EPA review although SW027 was brought back on line in July 1993. Of the four remaining storm water outfalls not currently being monitored, SW093, SW022, and SW118 will be brought back on line in March 1994 as part of the event-related storm water monitoring network, and SW998 will be deleted (EG&G 1993m). EPA has not yet determined the monitoring requirements under the forthcoming storm water permit including sampling locations,

parameters, and sampling frequency. Because storm water permits address storm water leaving a site, and the RFP permit will apply to the Industrial Area, storm water monitoring will not be required within the Industrial Area. Thus, any storm water monitoring needs within the Industrial Area must be identified by this Industrial Area IM/IRA.

5.2.2 Event-Related Monitoring Program

Under the Event-Related Monitoring Program, 21 gaging stations exist as of January 1994 and are designated by "GS" in Figure 5-1. Only GS10, GS13, GS19, GS20, and GS21 are near the perimeter of the Industrial Area. Extra equipment will be moved from GS13 to SW93. Both locations will then be equipped. A flume and a broad-crested weir on a head gate are currently located at GS13. The weir monitors runoff from the two subbasins draining the northeast corner of the Industrial Area. Approximately 7 acres in the Industrial Area are not monitored by the NPDES storm-water stations discussed in the previous section. Historically, water-level and flow data have been collected at this location, but not water quality data.

This network has evolved since 1989, and new stations are being established with automatic monitoring and sampling equipment being installed as funding becomes available. Of the 21 stations, only GS01 to GS13 are intended by EG&G to be long-term stations. GS19, GS20, and GS21 are temporary and will be deleted from the network in the near future because there is no long-term regulatory requirement for monitoring at these locations. This network is currently administered by USGS through an IAG with DOE, and data collection is coordinated by EG&G Surface Water Division (EG&G 1993m). Water level at the stations is monitored continuously. Water quality samples are collected when increases in stream stage trigger automatic samplers. Between 1989 and early 1994, the stations were set to collect water-quality samples at a small increase in stage in an effort to capture each run-off event. Samples were analyzed for the parameters listed in Table D of Appendix 5.1.

In January of 1994, USGS submitted a draft implementation plan to DOE for continued monitoring under the event-related program. In this work plan, they proposed to sample gaging stations GS01 through GS18, SW022, SW027, SW093, and SW118. Water-quality samples would be collected seasonally during a winter snow-melt event, spring run-off event, summer thunderstorm run-off event, and fall storm run-off event. Parameters to be measured are those summarized in Table D of Appendix 5.1.

5.2.3 Sewage Treatment Plant Monitoring

In addition to the storm water and event-related monitoring activities described above, the influent to the STP is currently monitored for pH and conductivity under the NPDES permit and for other parameters to meet the requirements of DOE orders. (See Table C in Appendix 5.1.) Respirometry methods are used to determine the presence of contaminants that inhibit the function of organisms within the activated sludge processes of the STP. The respirometer measures oxygen consumed and carbon dioxide generated by microbiological activity. Currently, a "grab" sample is taken once per shift for respirometry analysis. The existing permit does not specifically require respirometry for influent monitoring; however, any new permit is expected to require it. Additional monitoring requirements proposed for the flow equalization basins upgradient of the STP include pH, conductivity, Microtox™ and lower explosive limit (LEL) (e.g., for methane). Toxicity testing/monitoring using a Microtox™ instrument has also been used on a limited basis when a potential upset or contaminant was suspected; however, this monitoring is not required by any regulation or agreement. Microtox™ testing is used only as a characterization tool to determine whether additional chemical testing is needed. Microtox™ testing is not yet sufficiently reliable, but future applications are being investigated (EG&G 1993n; EG&G 1993o).

5.2.4 Real-Time Monitoring Capabilities

The Surface Water Division is currently working toward developing a permanent, automated, fixed station monitoring network to collect information for regulatory compliance and overall RFP surface water management. A real-time remote surface water monitoring system that employs radio-based telemetry hardware and computer control software is being developed as part of the overall surface water monitoring program. The use of a real-time system enables monitoring as stream stage changes occur and then stores and statistically analyzes the data. This kind of system also enables remote operation of certain devices (EG&G 1993p; EG&G 1993o).

Current measurement capabilities of the radio-based real-time system include hydrologic parameters such as precipitation, discharge, stage (water level) and, at selected locations, water-quality parameters including pH, temperature, dissolved oxygen, specific conductance, redox, salinity, and turbidity. Currently, 13 stations measure flow and water levels that are tied to the radiotelemetry network. The units are set up at the following locations: GS01, GS03 to GS07, GS09, GS12, GS13, GS19, GS21 (as shown in Figure 5-1), and the Pond B3 culvert. EG&G is in the process of upgrading flumes located at each of the gaging stations to more accurately translate stage measurements to flow.

Particle counters (which measure particles in the 1 to 150 micron range) have been used and evaluated at the drinking water treatment plant (Building 124) and at the OU2 discharge. These particle counters are portable units that can be connected to the real-time monitoring system. Particle counters help identify particulate movement and are important because transuranic radionuclides such as plutonium will often adhere to and be transported on particulates (EG&G 1993q).

The radio-based system is in a developmental phase and has the capability to be expanded to include additional stations as well as more complex instrumentation. The remote units

could additionally be capable of certain control functions, such as valve or pump operation. As a system safeguard, there are multiple data backup stations, located on the measurement units and at the central computer workstation. The emphasis in the development of this system is to ensure its reliability and the repeatability of the data measurements. To achieve this quality, system maintenance occurs on a frequent basis and includes examination and calibration of field instruments (EG&G 1993p). Real-time monitoring alternatives are further discussed in Section 5.6.

5.2.5 Summary Of Existing Monitoring Programs

As of January 1994, surface water monitoring at RFP includes of the following locations and analytes:

- compliance and operational monitoring of the A-, B-, and C-series terminal ponds and the STP (Appendix 5.1, Tables A through C);
- monitoring of the 21 gaging stations that are part of the ongoing event-related program; and
- monitoring of SW027 and SW023 (located with GS10), one of the six NPDES storm water stations as part of the event-related program.

Anticipated changes to the monitoring scheme over the next one to two years are as follows:

- At least three of the remaining NPDES stations will be upgraded and will be brought back on line. SW998 may be eliminated because it is upgradient of the Industrial Area.

- Gaging stations GS19 to GS21 will be removed from the event-related program. Stations GS14 to GS18 will monitor flow. The remaining stations will be equipped with automated flow measurement devices and automatic samplers as well as radiotelemetry capabilities to monitor, on a real-time basis, basic flow parameters such as precipitation, discharge, and stage.

- The USGS will collect at least seasonal water quality samples at all active monitoring stations. These samples will be analyzed for the parameters listed in Table D of Appendix 5.1.

Section 5.5 of this report evaluates the existing programs in terms of their ability to meet the objectives of this IM/IRA.

5.3 SUMMARY OF AVAILABLE DATA

After review of the documents identified in Section 5.1, it was determined that two general categories of surface water documents or data were available: those addressing base flow conditions and those addressing storm flow conditions. Because the data for storm water are generally more comprehensive, recent, and usable, the discussion of storm flow is more data-specific than the base flow discussion; however, both data sets are useful for identifying areas and contaminants of concern in the Industrial Area.

5.3.1 Base Flow

The EG&G Surface Water Division's Surface Water and Sediment Geochemical Characterization Reports for 1989 and 1990 (EG&G 1992j; EG&G 1992k) were determined to contain the most accurate and readily accessible base flow data pertinent to the Industrial Area. (Although base flow data were collected in 1991 and 1992, these data have not been statistically analyzed or compiled into a report.) These reports analyzed and interpreted surface water and sediment quality at RFP to provide a plant-

wide overview of contaminants in these media. In addition, the significance and impacts of past and potential future contaminant releases to and transport via the surface water pathway were assessed. Specific monitoring objectives follow:

- Provide support for the characterization of background surface water and sediment quality.
- Determine average conditions and summary statistics.
- Determine exceedances or excursions beyond a defined limit.
- Assess time trends and seasonality.
- Evaluate spatial patterns.
- Assess relationships between surface water quality and flow.
- Assess relationships between surface water quality and sediment quality.
- Delineate potential contaminant source areas.
- Assess contaminant fate and transport.

Variables monitored during this program included VOCs, SVOCs, and pesticides/PCBs on the CLP TCL; metals on the CLP inorganic TAL plus lithium, strontium, and tin; radionuclides; water quality indicator variables; and field variables prescribed by DOE, EPA, and CDH. Sediment samples were collected from stream channels at numerous locations and were also analyzed for these parameters with the exception of some field variables, indicator variables, and the dissolved components of all variables. In addition,

surface water stage and flow data were recorded during collection of some water or sediment samples.

Major conclusions of each year's findings, application of findings to the Industrial Area, and comparison to other selected documents follow. The discussion does not address findings presented in these reports for stations clearly outside the Industrial Area. For example, a number of conclusions addressed elevated analyte concentrations in the Present Landfill area. The Present Landfill is clearly outside the Industrial Area. References to elevated analyte concentrations in the landfill area, therefore, are not presented in this IM/IRA report.

5.3.1.1 Findings of the 1989 Surface Water and Sediment Characterization Report

During the 1989 study, 73 surface water stations and 25 sediment stations were sampled (Appendix 5.2 and Plate 5-1, which is provided at the end of this document). Of these stations, the 25 of particular interest to the Industrial Area are as follows: 903 Pad area (SW050, SW053, SW055, SW058, SW065, SW077), the Solar Ponds area (SW084 to 090, SW092 to SW095, SW105, SW106), and Upper South Walnut Creek (SW022, SW023, SW056, SW060, SW061/SED011, SW101) (EG&G 1992k).

Surface water stations were sampled on a monthly basis and sediment stations were monitored on a semiannual basis with a few exceptions. Semivolatile and pesticide/PCB analyses were conducted only on a semiannual basis at all nonbackground surface water stations. In addition, volatiles, semivolatiles, and pesticides/PCBs were not monitored at the nine background surface water stations. Statistical results for selected 1989 sampling activities are contained in Table 5-2. A discussion of these results by general area within the Industrial Area follows (EG&G 1992j).

For the Solar Ponds area, a variety of water quality parameters, organics and radionuclides were detected. In addition, the only PCB detected, Aroclor-1254, was

TABLE 5-2

Industrial Area IM/IRA/DD

1989 Surface Water and Sediment Geochemical Characterization Report Results

Selected water quality parameters, metals, organics, and radionuclides at selected locations in the Industrial Area.

	Solar Ponds				903 Pad				Upper South Walnut Creek			
PARAMETER	Average	Maximum	Standard Deviation	Sample Size	Average	Maximum	Standard Deviation	Sample Size	Average	Maximum	Standard Deviation	Sample Size
WATER QUALITY (mg/L)												
Specific Conductivity (µmhos/cm)	4,504	37,120	5,104	122	894	1,518	277	31	740	1,428	370	48
Dissolved Oxygen	4.99	23.00	3.23	122	2.39	10.10	2.31	31	6.60	70.00	9.82	48
Field pH	7.5	10.2	0.7	122	7.4	9.6	0.7	31	7.5	8.5	0.7	48
Total Dissolved Solids	5,104.5	41,000.0	7,567.9	119	496.2	790.0	140.0	34	422.0	3,300.0	451.6	51
Bicarbonate	325.5	1,000.0	176.3	119	390.1	710.0	141.7	34	283.4	540.0	158.8	51
Chloride	132.8	980.0	170.9	119	50.6	170.0	28.4	34	36.4	81.0	19.8	51
Nitrate	2,136.4	18,593.4	2,989.0	119	13.7	106.2	21.8	25	12.8	24.8	7.5	35
Nitrate/Nitrite	658.8	9,900.0	1,224.9	119	3.4	24.0	4.6	34	3.0	5.8	1.7	51
Sulfate	186.0	1,400.0	200.1	119	59.6	120.0	29.9	34	42.9	74.0	17.1	51
DISSOLVED METALS (mg/L)												
Aluminum	0.185	2.360	0.285	82								
Antimony	0.035	0.250	0.028	88	0.045	0.250	0.049	27				
Barium	0.127	0.725	0.093	91	0.203	0.343	0.076	27	0.136	0.244	0.499	33
Beryllium									0.002	0.005	0.001	29
Cadmium	0.005	0.048	0.007	88								
Calcium	227.80	1,490.00	248.57	91	110.80	145.00	22.84	27	83.81	133.00	37.75	33
Chromium	0.006	0.032	0.005	84								
Copper	0.019	0.091	0.017	80					0.013	0.029	0.003	27
Iron	0.253	9.860	1.123	86	0.735	8.540	1.819	27				
Lead	0.004	0.025	0.004	74								
Lithium	2.46	85.20	12.65	88								
Magnesium	57.62	390.00	62.20	91	18.86	30.50	7.40	27	15.98	29.10	7.18	33
Manganese	0.121	1.030	0.217	91	0.209	0.587	0.102	26	0.108	0.701	0.210	33
Mercury	0.000	0.002	0.000	86								
Molybdenum	0.048	0.250	0.026	91								
Nickel	0.022	0.087	0.010	87								
Potassium	162.37	3,330.00	438.52	89	3.36	16.00	3.10	25	2.21	2.50	0.60	29
Selenium	0.006	0.037	0.006	89	0.003	0.010	0.003	19				
Sodium	525.96	7,560.00	1,008.26	91	32.87	88.50	22.98	27	32.02	60.00	15.03	33
Strontium	1.78	11.90	1.81	88					0.52	1.17	0.19	31
Zinc	0.178	4.240	0.618	89	0.337	1.800	0.522	24	0.130	0.828	0.142	31
TOTAL RADIONUCLIDES (pCi/L)												
Americium-241	1.890	90.010	11.050	68	5.490	83.000	19.907	17	0.120	1.300	0.253	30
Cesium-137	0.114	4.700	0.693	76								
Gross alpha	197.49	1,398.00	284.26	70	67.37	350.00	98.79	17	66.35	780.00	152.72	31
Gross beta	240.71	2,500.00	376.00	70	17.71	65.00	14.48	17	51.36	570.00	116.98	31
Plutonium-239	2.433	120.000	14.463	73	16.195	110.000	30.240	17	0.397	3.300	0.876	32
Radium-226	1.615	20.000	3.640	59					1.922	7.200	2.260	18
Strontium-90	0.350	3.200	0.604	76					0.193	2.200	0.499	32
Tritium	2,000.77	13,000.00	2,406.80	78					100.83	500.00	196.76	32
Uranium, Total	127.58	1,023.00	189.16	49	7.80	18.10	5.70	11	5.65	16.60	3.37	25
Uranium-233, -234	101.23	880.80	170.50	76	6.47	10.00	2.56	17	2.92	7.70	1.70	32
Uranium-235	4.34	85.50	9.91	76	0.16	0.70	0.19	17	0.17	1.00	0.19	32
Uranium-238	54.33	388.00	77.59	76	2.93	7.80	2.15	17	2.52	7.90	1.42	32
DISSOLVED RADIONUCLIDES (pCi/L)												
Americium-241	0.038	0.840	0.147	19								
Cesium-137	0.049	0.900	0.364	19					0.000	0.600	0.590	6
Gross alpha	284.263	1,900.000	439.612	19	5.000	8.000	4.240	2	5.500	18.000	5.848	6
Gross beta	393.421	3,600.000	886.595	19								
Plutonium-239	0.148	2.400	0.547	19	0.100	0.200	0.141	2				
Uranium-235	3.126	12.800	3.364	19								
Uranium-238	48.226	130.000	45.073	19								
VOLATILE ORGANICS (µg/L)												
1,1-Dichloroethane									4.689	50.000	8.030	37
1,2-Dichloroethylene	3.549	15.000	2.989	81	7.200	44.000	11.929	25				
Acetone	19.286	180.000	35.843	56					12.897	130.000	25.540	29
Carbon Disulfide	3.617	19.000	3.256	77								
Carbon tetrachloride	8.179	100.000	15.843	81	4.520	46.000	8.772	25	46.861	430.000	95.466	36
Chloroform	3.512	12.500	2.880	81	2.940	8.000	1.294	25	18.417	82.000	23.630	36
Ethylbenzene	3.432	12.500	2.704	81								
Methylene Chloride	4.540	12.500	3.608	47	2.825	9.000	1.453	20	3.280	11.000	2.020	25
Tetrachloroethene					3.920	19.000	4.185	25	53.095	280.000	83.694	37
Trichloroethene	3.408	12.500	2.750	80	10.940	65.000	15.780	25	41.040	280.000	62.500	37
Vinyl chloride									7.135	25.000	5.056	37
SEMIVOLATILE ORGANICS (µg/L)												
Bis[2-ethylhexyl]-phthalate	7.385	32.000	8.968	13	(None Detected)				(None Detected)			

Source: (EG&G 1992j). Adapted from 1989 Surface-Water And Sediment Geochemical Characterization Report. Final. April, 1, 1992.

NOTES:

mg/L = milligrams per liter
pCi/L = picoCuries per liter
µg/L = micrograms per liter
µmhos/cm = micromhos per centimeter

found in this area at SW105, although its concentration was close to detection limits. Specific conductivity, pH, TDS, sulfate, chloride, bicarbonate, nitrite/nitrate, and nitrate showed relatively high concentrations in the Solar Ponds area. The highest concentrations of most detected metals in the Industrial Area were at the Solar Ponds. Levels of dissolved metals that were elevated with respect to background concentrations in surface water (EG&G 1993r) throughout the area included cadmium, calcium, lithium, magnesium, manganese, nickel, potassium, sodium, strontium, and zinc. The area around the Solar Ponds generally exhibited the highest concentrations of radionuclides among the monitoring stations within the Industrial Area. Generally high levels of radionuclides included total and dissolved gross alpha, gross beta, uranium-235, uranium-238, plutonium-239, total americium-241, tritium, uranium-233, uranium-234, total uranium, and dissolved cesium-137. VOCs detected in the area included CCl_4, 1,2-DCE, acetone, methylene chloride, ethylbenzene, TCE, carbon disulfide, and chloroform. The report stated that acetone and methylene chloride may have been laboratory contaminants. The semivolatile bis(2-ethylhexyl) phthalate was detected three times in the Solar Ponds area at SW105, SW090, and SW092 (EG&G 1992b).

For the 903 Pad area, dissolved oxygen values were relatively low, and pH and nitrate concentrations were relatively high. The majority of the elevated metals concentrations at the 903 Pad were detected at SW055 and/or SW056. Elevated dissolved metals concentrations included barium, calcium, iron, magnesium, manganese, potassium, sodium, and zinc. Relatively high concentrations of total gross alpha, gross beta, americium-241, plutonium-239, uranium-233, uranium-234, uranium-238, and total uranium were also detected. Uranium-238 exhibited high concentrations at SW065 and SW055. Volatiles detected throughout the 903 Pad area include TCE and 1,2-DCE. Some elevated levels of CCl_4, PCE, and chloroform were also detected at several locations (EG&G 1992a).

For the Upper South Walnut Creek area, nitrate levels were relatively high, and dissolved oxygen values were low at SW056 and SW059. Elevated dissolved metals

concentrations throughout this area were measured for calcium, magnesium, manganese, sodium, and zinc. Elevated total radionuclide concentrations included gross alpha, gross beta, plutonium-239, uranium-233, uranium-234, uranium-238, and total uranium. Total americium-241, radium-226, and uranium-235 were also elevated at specific individual stations. Cesium-137 and gross alpha were the only elevated dissolved radionuclides. This area exhibited the highest concentrations of volatile organics at the site. Widespread organics included CCl_4 PCE, and TCE. Chloroform, acetone, 1,1-DCE, and methylene chloride were also detected at elevated levels at individual locations. Although vinyl chloride showed a high mean value, this was a result of an artificial maximum value of 25 μg/L based on half of the detection limit of 50 μg/L (EG&G 1992b).

5.3.1.2 Findings of the 1990 Surface Water and Sediment Characterization Report

The major emphasis of the 1990 study (EG&G 1992k) was the identification of trends and processes affecting the nature and extent of contaminants in surface water and sediment. Surface water data that were used in the report were retrieved from RFEDS for 98 sampling locations, which are listed by general area in Appendix 5.2 (and depicted on Plate 5-1). After verification of data, statistical and qualitative analyses were performed for the following purposes: characterization of major ion chemistry, identification of areal trends for collected constituents, determination of differences in constituent concentrations between background stations and downstream stations, and investigation of geochemical trends and relationships.

The only organic constituents examined in this report were TCE, CCl_4, and toluene. These constituents were selected because they were believed to be indicative of VOC contamination at RFP because these compounds were widely used in past RFP operations. For example, toluene was investigated because it was thought to be a major component of soil binders sprayed to inhibit soil erosion and transport.

Organic contaminants were found in selected bottom sediment samples, but the number of sediment samples acquired in 1990 were too few to statistically summarize. Box plots of TCE and CCl_4 showed that they were generally present in surface water in low concentrations close to analytical detection limits. The maximum concentrations of TCE and CCl_4 for 1990 were in the OU2 area at SW050, SW055, SW056, SW059 to SW061, and SW064, which are located within the Industrial Area boundaries or along the southeastern boundary. The maximum TCE concentration of 200 $\mu g/L$ was observed at SW059. Overall, organic compound contamination in RFP surface waters appeared to be limited to seeps where contaminated groundwater issues at the surface. For the Industrial Area, these contaminated seeps appeared to be contained in the 903 Pad and Lip areas (SW050, SW055, SW064) and the Mound Area (SW056, SW059, SW060, SW061) of OU2.

Radionuclide characterization involved evaluating activities of gross alpha, gross beta, uranium-235, uranium-236, plutonium-239, plutonium-240, and americium-241. The Solar Ponds area surface water (SW087 to SW090, SW105) samples exhibited higher gross alpha and gross beta activity than the surface water in the Woman Creek, South Walnut Creek, and Rock Creek drainages. The maximum gross alpha activity of 1,750 picocuries per liter (pCi/L) was located at SW090 in the Solar Ponds area. In general, the samples taken in the Solar Ponds area were from sumps and seeps draining the colluvium near the Solar Ponds. The Solar Ponds area also showed elevated uranium-235 and uranium-236 activities. Radionuclide activities were low at SW092 and SW093, located downgradient from the Solar Ponds, indicating that contamination of Walnut Creek from the Solar Ponds was not occurring. Many radiochemical data were missing at many stations; thus, the only conclusions drawn with regard to radionuclide contamination were at the Solar Ponds, and these conclusions were considered to be preliminary.

Characterization of metals and other inorganics addressed the following constituents: total suspended solids (TSS); cyanide; selected metals including zinc, beryllium,

chromium, mercury, and lead; and nitrate and nitrite. TSS concentrations were similar plant wide. Very few cyanide concentration data were available for 1990, particularly for the Industrial Area. Zinc concentrations were low in the Industrial Area. Total beryllium concentrations were near the detection limit plant wide with the exception of three stations in the Solar Ponds area, which were considered to be statistical outliers.

Total chromium, lead, and mercury concentrations were near analytical detection limits plant wide. Nitrate and nitrite concentrations were highest in (and appeared to be restricted to) the Solar Ponds area seeps and sumps and at SW094 and SW095 in the Solar Ponds french drain.

Few surface water stations were examined on the south side of the Industrial Area; the closest stations were those in the SID and upper Woman Creek. Selected organics, metals, and radionuclide concentrations in upstream and downstream Woman Creek and the SID were low, and upstream concentrations did not significantly differ from downstream concentrations. Uranium activities for the SID appeared slightly higher than the Woman Creek waters, possibly because the SID receives contaminated runoff from the old landfill.

Inadequate discharge and water quality data prevented definition of fate and transport of contaminants in surface waters for 1990. Geochemical relationships between constituent activities or concentrations and environmental variables, such as pH, specific conductivity, stream flow, dissolved oxygen, alkalinity, and TSS, were investigated on a plant wide scale and on a watershed scale; however, no definitive correlations between variables were observed based on regression analysis. Analysis of radionuclide isotopic ratios to assess natural versus anthropogenic sources of radionuclides was also attempted, but few definitive conclusions were made.

General results of statistical analyses showed statistically significant differences from background concentrations/activities in each of the drainages at RFP. In addition,

although several operations affect water quality at the site, the most serious source of contamination was identified as the Solar Ponds. The results also indicated that contaminants including radionuclides might be transported from the old landfill, the 903 Pad, and the Lip area to the SID. The most contaminated surface waters investigated were in the Solar Ponds sumps and seeps followed by the seeps in OU2 (the 903 Pad and Mound areas).

Conclusions drawn were considered limited and preliminary because of the limited data. Sediment data collected during 1990 were insufficient to conduct statistical analysis. Adequate discharge and water quality data were not available for defining the fate and transport of contaminants in RFP surface waters for 1990.

5.3.1.3 Summary of Results and Comparison to Other Studies

Based on the data collected and evaluated in the 1989 and 1990 Surface Water and Sediment Geochemical Characterization reports (EG&G 1992j; EG&G 1992k), areas of surface water contamination within the Industrial Area include the Solar Ponds area (OU4), the 903 Pad area (OU2), and Upper South Walnut Creek near the northeastern Industrial Area boundary (Mound area, OU2). In the Solar Ponds area, major elevated constituents included specific conductivity, pH, chloride, sulfate, nitrite/nitrate, various metals, a variety of radionuclides, VOCs, and SVOCs as well as one PCB detection. In the 903 Pad area, radionuclides, VOCs, and a few metals were elevated. In the Upper South Walnut Creek area, metals, plutonium, and VOC levels were elevated. Radionuclides and organics of concern in these areas are shown in Table 5-3. In most cases, the highest levels of contamination were found in seeps, and in the case of the Solar Ponds, in the sumps, seeps, and french drain.

A surface water IM/IRA is being implemented at OU2, which includes the 903 Pad and Mound areas and is based in part on the data collected during 1989 and 1990 under the Surface Water and Sediment Monitoring Program. The IM/IRA treats surface water

TABLE 5-3
Industrial Area IM/IRA/DD
Primary Organic and Radionuclide Contaminants in the Industrial Area Identified in the 1989 and 1990 Surface Water and Sediment Geochemical Reports

	Solar Ponds	903 Pad	Upper S. Walnut Creek (Mound Area)
ORGANICS			
Acetone	X		X
Bis [2-Ethylhexyl]-Phthalate	X		
Carbon Tetrachloride	XX	XX	XX
Chloroform	X	X	X
1,2-Dichloroethylene	X	XX	
Methylene Chloride	X		X
PCE		X	XX
TCE		XX	XX
PCBs (Aroclor-1254)	X		
RADIONUCLIDES			
Americium-241	XX	XX	
Gross Alpha	XX	XX	XX
Gross Beta	XX	XX	XX
Plutonium-239	XX	XX	
Tritium	XX		
Uranium-233,234	XX		
Uranium-235, 236	XX		
Uranium-238	XX		
Total Uranium	XX		

Note: PCB = polychlorinated biphenyl
PCE = tetrachloroethene
TCE = trichloroethene
XX = widespread contaminant
X = contaminant detected at individual monitoring location, but not widespread

contamination consisting primarily of TCE, PCE, CCl_4 and associated degradation products. Several metals, uranium, and other inorganic constituents were also noted to be above background in environmental media, but no strong conclusions were drawn regarding these constituents, and they were designated to be investigated in the context of long-term remediation. South Walnut Creek Basin surface water in the Mound area,as characterized by data for stations SW056, SW059, SW060, SW061, and SW101, showed CCl_4, TCE, and PCE in concentrations in excess of 200 μg/L, with lower and infrequent concentrations of 1,1-DCE, 1,1-DCA, 1,2-DCE, vinyl chloride, acetone, bromodichloromethane, and methylene chloride. These stations also frequently showed high surface water concentrations for TDS and uranium. Seeps in the vicinity of the 903 Pad Lip Site (SW050, SW053, SW054) had detectable plutonium and/or americium during one or more sampling events in 1989. The source of these radionuclides was theorized to be contaminated soils (DOE 1992b; EG&G 1991g).

Under the IM/IRA for OU2, surface water from SW059, SW061, and SW132 is currently collected for treatment. SW059 is a seep, SW061 is located at the outlet of a concrete culvert, and SW132 is located at a buried corrugated metal culvert approximately 225 feet downgradient of SW061. The SW132 culvert was identified as a conduit for flow from the upper reach of South Walnut Creek from within the Protected Area. The surface water at these locations is collected upstream of the B-series ponds to reduce the potential of further downstream contamination. A treatment system consisting of a chemical precipitation/cross-flow membrane filtration system in combination with a granular activated carbon (GAC) adsorption system was installed to remove heavy metals, radionuclides, and VOCs from the seeps. The combined flows from the three seeps are approximately 15.2 gpm most of the year. During high flow periods (10 to 20 days per year) resulting from high precipitation events, the 60-gallon-per-minute (gpm) capacity of the treatment system is exceeded (DOE 1992b).

OU4, which addresses the Solar Ponds, is currently undergoing the Phase I RFI/RI process and has a collection and treatment system in place for waters contaminated with heavy metals, radionuclides, and nitrates (DOE 1992c). A preliminary analysis shows

that the Interceptor Trench Pump House (ITPH) system established in 1980-81 effectively collects alluvial groundwater and seeps (and significant quantities of storm water runoff) in areas where the system is keyed into bedrock. This system does not effectively collect alluvial groundwater where the ITPH is not keyed into bedrock, particularly to the east-northeast of the Solar Ponds where a nitrate-contaminated plume is believed to exist. In addition, the west collector, which contains high levels of VOCs, is no longer hydraulically connected to the ITPH. Noting these two exceptions, collected water is transferred to temporary modular storage tanks (TMSTs) located northwest of the Solar Ponds (as of April 1993) and eventually transferred to flash evaporators in Building 910 or the Building 374 process waste treatment system for treatment.

Finally, it is necessary to note that based on the Surface Water and Sediment Geochemical reports (EG&G 1992j; EG&G 1992k), there are limited data with regard to the western and south central portion of the Industrial Area. In addition, efforts to backtrack water quality in the Upper SID to sources in the western Industrial Area were not successful because of limited data and multiple contamination sources to the SID. According to the 1989 report (EG&G 1992a), it is possible that IHSSs in the western Industrial Area may contribute to elevated levels of sulfate, radionuclides, and some metals in the upper SID. The 1990 report (EG&G 1992k) noted gross alpha, gross beta, plutonium-239, plutonium-240, uranium, nitrite/nitrate, and TSS elevated above background, but it did not identify any probable contamination source in the western or south central Industrial Area; instead, it focused on the old landfill, the 881 Hillside area, and the americium zone as potential contamination sources. The americium zone is the area southeast (downwind) of the 903 Pad. Americium is thought to be present in this area because plutonium from the 903 Pad was wind transported and has decayed to become americium.

5.3.2 Storm Water

The most recent and complete data regarding storm water are contained in two reports titled *Event-related Surface Water Monitoring Report for the Rocky Flats Plant for Water Years 1991 and 1992* (EG&G 1993k) and *Stormwater NPDES Permit Application Monitoring Program for RFP* (ASI 1993). Additional data are contained within the *NPDES Permit Application* (DOE 1992d) submitted to EPA in October 1992, as well as the *Draft Surface Water Management Plan* (EG&G 1992i). Table 5-4 displays parameters analyzed or reported in each of the studies or sampling efforts.

It is difficult to quantitatively compare the results from the individual sampling programs because of differences in constituents analyzed as well as differences in analytical methods, laboratories, detection limits, and sampling methodologies. In addition, the latter two reports do not significantly add to an understanding of available storm water data; thus, the following discussion focuses on the first two reports.

5.3.2.1 Findings of the Event-related Surface Water and Sediment Monitoring Report for the Rocky Flats Plant for Water Years 1991 and 1992

Data presented in the report were collected from water years 1991 and 1992 (defined by the USGS as October 1990 to September 1991 and October 1991 to September 1992) at 12 gaging stations that are part of the RFP Gaging Station and Storm Water Monitoring Network (Figure 5-1), discussed in Section 5.2. The goal of the report was to evaluate surface water hydrology and constituent fate and transport at RFP. The gaging stations sampled include GS01 to GS07 and GS09 to GS13. (GS08 currently does not receive any flow because of transfer of water from Pond B-5 to A-4 via pipeline [EG&G 1993k].)

The report included annual hydrographs of mean daily discharge for the 12 gaging stations, total radionuclide activity and total metal concentration and loading data for

TABLE 5-4
Industrial Area IM/IRA/DD
Parameters Reported in Relevant Storm Water Documents

Parameter	NPDES Storm Water Report Parameters Tested (1)	Event-Related Report Parameters Tested (2)	NPDES Individual Permit 10/92 Parameters Tested (3)	SWMP 1990-1991 Data (4)
Dissolved Oxygen				X
Fecal Coliforms				X
Nitrite				
Nitrate				
Residual Chlorine				
Free Cyanide				
Sulfide (Hydrogen sulfide)				X
Boron				
Americium		X		X
Cesium 134		X		
Gross Alpha		X		X
Gross Beta		X		X
Plutonium		X		X
Radium 226 and 228		X		X
Strontium 90		X		
Thorium 230 and 232		X		
Tritium		X		X
Uranium		X		X
Aluminium	X	X	X	
Antimony	X	X	X	X
Arsenic	X	X	X	X
Barium	X	X	X	X
Beryllium	X	X	X	X
Cadmium	X	X	X	X
Chromium	X	X	X	X
Cobalt	X	X	X	X
Copper	X	X	X	X
Iron	X	X	X	X
Lead	X	X	X	X
Manganese	X	X	X	X
Mercury	X	X	X	X
Molybdenum	X	X	X	X
Nickel	X	X	X	X
Selenium	X	X	X	X
Silver	X	X	X	X
Strontium	X	X	X	X
Thallium	X	X	X	X
Vanadium	X	X	X	X
Zinc	X	X	X	X
Calcium	X	X		X
Magnesium	X	X		X
Potassium	X	X		X
Sodium	X	X		X
	X			
Alkalinity	X		X	X
Sulfate	X		X	X
Chloride	X		X	X
Fluoride	X		X	X
pH	X		X	X
Specific Conductance	X			
Dissolved Solids	X		X	X
Total Suspended Solids	X		X	X
Ammonia as N	X			X
Nitrate/Nitrite as N	X		X	
Total Phosphorus as P	X		X	X
Organics		X	X	X

(1) = *Storm Water NPDES Permit-Application Monitoring Program, Rocky Flats Plant Site* (ASI 1993)
(2) = *Event-Related Surface Water Monitoring Report for the Rocky Flats Plant for Water Years 1991 and 1992* (EG&G 1993k)
(3) = NPDES Permit Application submitted 10/92 (DOE 1992d)
(4) = *Draft Surface Water Management Plan* (EG&G 1992l)

selected storm events, suspended sediment concentration data, annual RFP precipitation hyetographs, and interpretation of metal and radionuclide loading in the RFP drainages. The two stations of particular interest because of their proximity to the Industrial Area are GS13 (co-located with SW092) and GS10 (co-located with SW023).

For 1991-1992, sample collection was limited to investigation of total radionuclide and total metals transport. Because the automatic samplers installed at the gaging stations cannot currently collect a representative sample for VOCs, a limited number of samples were manually collected specifically for organic analysis. Data analysis included use of major cations (calcium, magnesium, sodium, and potassium) and trace metals (aluminum, iron, and zinc) to investigate relationships between constituent transport and sediment transport in the absence of suspended sediment data. Few suspended sediment data were available for this report because of late 1992 installation of automatic suspended sediment samplers.

Because of the limited quantity of data, analyte concentrations near the analytical detection limit and questionable discharge data quality, the following general conclusions were made based on observation of trends in the data rather than extensive statistical analysis:

1. Total metal and radionuclide loads in Walnut Creek appeared to be higher than overall constituent loads in other RFP drainages because of runoff from impervious areas within the Industrial Area of the plant. This conclusion was made without statistical verification because of limited data quantity (EG&G 1993k).

2. Total metal and radionuclide loads measured at gaging stations upstream from the RFP A- and B-series detention ponds appeared to be higher than overall constituent loads measured at gaging stations downstream from the detention

ponds. This measurement indicates the removal of constituents from the water column in the ponds (EG&G 1993k).

3. Plutonium-239/240 activity increased with increasing aluminum and iron concentrations in the Walnut Creek drainage, indicating that the plutonium was associated with iron-coated or iron-containing aluminosilicates in transported suspended sediment (EG&G 1993k).

4. Uranium-238 activity and major cation concentrations decreased with increasing stream discharge at station GS13 on North Walnut Creek, indicating dilution of these constituents, which were likely transported from natural sources. Trace metal concentrations increase with increasing stream discharge at GS13, indicating flushing of metals from impervious portions of the Core area or from wetland areas that might attenuate metal transport (EG&G 1993k).

5. Americium-241 activity decreased with increasing stream discharge at station GS10 in South Walnut Creek, indicating dilution of an americium-241 source (EG&G 1993k).

6. Major cation and trace metal loads were within the same order of magnitude in each RFP drainage, indicating no significant anthropogenic source of metal constituent loading to RFP streams. However, this conclusion was based on observation of only selected metal loads, which were calculated based on data obtained from analytical methods that may not have adequate sensitivity (EG&G 1993k).

7. Pesticides and SVOCs were monitored during two storm events; no compounds were detected at detection limits that ranged from 10 to 50 μg/L.

The report noted that these results are preliminary and subject to revision and that the interpretation of the data may change as additional data become available and as upgrades to the monitoring network are made (particularly the collection of more accurate flow data). Additional data are also expected to facilitate the statistical quantification of significant differences in water quality between stations.

With regard to GS10 and GS13, which are closest to the Industrial Area, GS13 captures runoff directly from the northeast corner of the Industrial Area but is diluted with upstream flow from North Walnut Creek. GS10, located at the eastern boundary of the Industrial Area, drains a much larger portion of the Industrial Area and is less likely to be diluted by non-Industrial Area waters. Metal and radionuclide data collected at these two stations are summarized in Table 5-5. Metal concentrations between the two stations do not appear to differ significantly. Except for uranium-235 and uranium-238, radionuclide concentrations were greater at GS10 than at GS13.

5.3.2.2 Findings of the Storm Water NPDES Permit Application Program Report

The Storm Water NPDES Permit Application Monitoring Program for RFP was conducted by ASI in response to Clean Water Act (CWA) NPDES requirements. The goal of the program was to collect water-quality samples during storm runoff or high flow events at selected sites to characterize runoff quantity and quality at RFP (ASI 1993).

The report, *Stormwater NPDES Permit Application Monitoring Program Rocky Flats Plant Site* (ASI 1993), provides data on precipitation, hydrologic parameters including mean daily discharge and event-specific discharge, and water quality for the six NPDES monitoring stations located in the main channels that drain the RFP Industrial Area. Sample locations included in the program were SW022, SW023, SW027, SW093, SW118, and SW998. (See Figure 5-1.) The resulting report describes the comprehensive

TABLE 5-5
Industrial Area IM/IRA/DD
Mean Concentration of Constituents in Storm Water Collected at GS10 and GS13

Metals (µg/mL)	GS10 Mean	Standard Deviation	GS13 Mean	Standard Deviation
Aluminum	11100	6510	12400	12200
Antimony	20.4	7.01	24.4	11.8
Arsenic	2.89	1.47	2.04	1.26
Barium	143	75.4	150	66.1
Beryllium	1.08	0.63	1.10	0.74
Cadmium	2.68	0.69	3.37	0.84
Calcium	38200	13900	42300	17700
Cesium	393	186	377	210
Chromium	13.8	7.24	12.9	10.9
Cobalt	4.83	2.59	5.72	2.90
Copper	27.3	19.4	15.9	10.8
Iron	3710	3130	3320	2370
Lead	24.3	13.9	14.7	14.1
Lithium	10.5	4.39	13.4	5.56
Magnesium	8970	3780	15800	16100
Manganese	258	230	290	271
Mercury	0.88	2.03	0.30	0.27
Molybdenum	9.27	7.85	13.6	8.42
Nickel	365	1170	13.6	7.43
Potassium	5900	6110	4820	1800
Selenium	1.37	1.29	2.10	1.24
Silicon	21100	10000	16000	18100
Silver	3.78	2.27	5.30	2.27
Sodium	19300	7430	27500	10600
Strontium	234	99.3	262	114
Thallium	1.78	0.54	2.10	0.33
Tin	29.3	52.1	37.6	55.4
Vanadium	27.5	18.4	28.9	26.3
Zinc	312	279	124	102
Radionuclides (pCi/L)				
Plutonium-239	0.183	0.202	0.038	0.024
Americium-241	0.115	0.142	0.070	0.055
Uranium-235	0.079	0.081	0.129	0.118
Uranium-238	1.007	0.537	2.004	1.333

Notes: Values calculated from data presented in the *Event-Related Surface Water Monitoring Report for the Water Years 1991 and 1992* (EG&G 1993m)

pCi/L = picocuries per liter; µg/mL = micrograms per milliliter

results of the monitoring program including water quality data and stream flow records of storm water events.

A total of 116 surface water samples and 19 bulk-precipitation samples were collected and analyzed during a 15-month period from October 1991 through December 1992 during 32 storm or high-flow events. Chemical analyses were performed for surface water samples for selected trace metals, anions, and nutrient species. Sampling activities included first-flush and hydrograph-integrated flows.

Table 5-6 summarizes the first-flush sampling data. The first-flush sampling was accomplished by collecting samples from the beginning of the storm runoff at 1.5-minute intervals until the stream channel stage declined below a preset level, or alternatively, all 24 sample bottles were filled. These samples provided a characterization of the "first flush" from the drainage areas that occurs within the first 30 minutes of storm runoff or high flow. Table 5-7 summarizes the hydrograph-integrated storm water quality data for surface water stations. The integrated samples were taken from the beginning of the storm runoff at preset time intervals until the stream-channel stage declined to a preset level. Generally, these samples provided an integrated water-quality characterization over the prolonged storm-runoff/high-flow hydrograph period.

All of the metals reported in Tables 5-6 and 5-7 are total recoverable metal concentrations. Metals having the highest concentrations in the storm-runoff samples were consistently aluminum and iron. Anion and nutrient species concentrations at all sites were judged to be at reasonable levels associated with storm runoff. Only one storm event was successfully sampled for organics because of the timing of the storm events coupled with the standard sampling methods, which necessitate manual "grab" samples. (This sample result was not provided in the report, although it was included in the actual permit application.)

TABLE 5-6
Industrial Area IM/IRA/DD
First Storm Water Quality Data from November 1991 to August 1992

Parameter	Maximum Value SW022	Average Value SW022	Maximum Value SW023	Average Value SW023	Maximum Value SW093	Average Value SW093	Maximum Value SW118	Average Value SW118	Maximum Value SW027	Average Value SW027	Maximum Value SW998	Average Value SW998
RADIONUCLIDES (pCi/L)												
Americium												
Cesium 134												
Gross Alpha												
Gross Beta												
Plutonium												
Radium 226 and 228												
Strontium 90												
Thorium 230 and 232												
Tritium												
Uranium												
METALS (µg/L) (1)												
Aluminum	59,900	22,245	26,400	10,770	39,400	16,264	113,000	24,793	7,370	2,241	N/A	N/A
Antimony	56.8	24.6	44.8	16	19.9	12.2	76.6	24.8	24.9	16.7	N/A	N/A
Arsenic	37.5	18.6	70.5	30	37.5	28.1	79.2	40.1	37.5	28.3	N/A	N/A
Arsenic (2)	3.6	2.63	17.8	6.4	26.1	9.62	11.6	4.28	2.6	1.15	N/A	N/A
Barium	317	160	318	163	298	174	663	228	116	103	N/A	N/A
Beryllium	2.4	1.28	1.7	0.58	1.5	0.82	3.3	1.09	0.5	0.45	N/A	N/A
Cadmium	6.6	2.8	5.9	2.29	4.6	2.31	2	1.46	8.7	3.56	N/A	N/A
Chromium	86.3	32.5	37.3	19.3	49.9	21.5	165	27.3	10.7	4.81	N/A	N/A
Cobalt	21.3	8.98	12.4	5.67	14.7	8.98	31.8	8.61	3.5	2.9	N/A	N/A
Copper	78	36.6	64.9	33.3	44.8	28.6	84.3	25.8	9.4	4.48	N/A	N/A
Iron	60,800	23,433	27,300	12,541	34,500	16,248	80,500	22,191	6,160	1,915	N/A	N/A
Lead	141	66.9	76.4	37.9	63.8	30.4	45	29.7	27	20.5	N/A	N/A
Lead (2)	560	44.2	149	39	97	52.8	74.9	17.4	2.9	1.55	N/A	N/A
Manganese	0.1	292	3,370	648	1420	576	1820	554	78.2	33.1	N/A	N/A
Mercury (3)	6	0.1	0.1	0.1	0.21	0.12	0.23	0.12	0.1	0.1	N/A	N/A
Molybdenum	51.9	4.18	6	4.78	6	5.32	7	5.52	6	5.4	N/A	N/A
Nickel	31	25.3	34.5	12.3	32.2	16.1	69.5	24.6	9.5	8.36	N/A	N/A
Selenium	31	22.7	40	19.5	31	22.4	40	24.7	31	23.5	N/A	N/A
Selenium (2)	1	0.77	3.1	1.16	1.7	1.04	2	1.15	1.9	0.85	N/A	N/A
Silver	3.5	2.43	35	3.96	2.5	2	7	3.4	2.5	2.13	N/A	N/A
Strontium	201	133	403	224	158	121	461	261	395	298	N/A	N/A
Thallium	144	53	288	64.5	66.5	46.3	288	97.9	148	70.4	N/A	N/A
Thallium (2)	0.5	0.5	2.3	0.7	3	1.16	5.5	1.43	0.5	0.5	N/A	N/A
Vanadium	142	55.3	62.6	29.3	88.8	40.8	235	56.1	19.5	8.38	N/A	N/A
Zinc	444	234	1,020	490	594	304	566	187	66.7	34.9	N/A	N/A
INORGANICS (mg/L)												
Calcium	44.3	30.8	70.5	41.1	32.8	22.3	65.9	36.6	64.8	49.6	N/A	N/A
Magnesium	13.2	7.27	18.1	9.06	8.85	6.36	30.2	12.9	13.5	10.3	N/A	N/A
Potassium	11.8	6.29	36.1	7.64	7.04	4.84	16.3	5.97	6.53	4.58	N/A	N/A
Sodium	47	17.2	136	27.3	18.2	11.9	153	60.8	31.9	24.8	N/A	N/A
Alkalinity	73.7	45.2	157	100	61.3	39.8	242	85	162	126	N/A	N/A
Sulfate	8	5.2	41.7	17.1	11.7	6.18	25	11.8	58	34.4	N/A	N/A
Chloride	133	29.6	308	54.1	66	23.8	292	118	69	58	N/A	N/A
Fluoride	1	0.48	10.2	0.94	0.8	0.53	1	0.43	0.38	0.27	N/A	N/A
pH	8	7.7	7.9	7.4	8	7.4	8	7.5	7.7	7.4	N/A	N/A
Specific Conductance	420	216	640	375	300	213	1300	694	700	495	N/A	N/A
Dissolved Solids	264	139	722	239	647	199	621	301	404	288	N/A	N/A
Total Suspended Solids	926	520	1,258	441	998	467	3,031	672	95	34	N/A	N/A
Ammonia as N	0.39	0.14	1.3	0.34	0.44	0.18	1.5	0.22	0.1	0.04	N/A	N/A
Nitrate/Nitrite as N	2.75	1.14	2.01	1.35	1.29	0.96	3.14	0.74	1.3	0.74	N/A	N/A
Total Phosphorus as P	1.5	0.62	2.31	0.68	2.4	0.58	1.05	0.39	0.12	0.07	N/A	N/A

NOTES:

First-flush samples were taken from beginning of the storm runoff at 1.5-minute intervals until the stream-channel stage declined below a preset level or until all were filled. Sampling data collected from October 1991 to December 1992. Data were reported in the NPDES Permit Application Monitoring Report for RFP (ASI 1!
(1) All storm water quality metals data are total recoverable concentrations.
(2) Analytical method used was graphite furnace atomic absorption spectroscopy.
(3) Analytical method used was cold vapor atomic absorption spectroscopy.

ABBREVIATIONS:

ASI = Advanced Science, Inc.
mg/L = milligrams per liter
pCi/L = picoCuries per liter
µg/L = micrograms per liter

TABLE 5-7
Industrial Area IM/IRA/DD
Hydrograph Integrated Storm Water Quality Data from November 1991 to August 1992

Parameter	Maximum Value SW022	Average Value SW022	Maximum Value SW023	Average Value SW023	Maximum Value SW093	Average Value SW093	Maximum Value SW118	Average Value SW118	Maximum Value SW027	Average Value SW027	Maximum Value SW998	Average Value SW998
RADIONUCLIDES (pCi/L)												
Americium												
Cesium 134												
Gross Alpha												
Gross Beta												
Plutonium												
Radium 226 and 228												
Strontium 90												
Thorium 230 and 232												
Tritium												
Uranium												
METALS (µg/L) (1)												
Aluminum	24,100	5,840	38,900	11,828	34,800	13,018	78,200	22,234	20,200	4,604	11,600	5,423
Antimony	402	68.5	55.6	20.2	34.9	19	53.6	16.6	12.5	12	12.5	10
Arsenic	69	31	72	27.8	37.5	27.3	37.5	26.6	37.5	31.3	37.5	23.5
Arsenic (2)	6.5	2.71	14.9	5.6	7.2	2.9	16.9	4.28	1.9	0.82	3.9	2.2
Barium	200	79.6	282	139	225	132	509	259	179	112	62.5	38.9
Beryllium	2.2	0.79	1.5	0.58	1.5	0.7	1.8	0.78	0.5	0.47	0.5	0.43
Cadmium	7	2.65	3.7	1.83	5.6	2.54	2	1.51	2	1.93	2	1.52
Chromium	34.9	10.9	53.4	19.6	39.1	16	72.8	22.6	25.5	6.68	21.7	10.1
Cobalt	11.6	4.64	13.7	5.15	8.5	6.2	24.1	8.01	3.5	3.1	3.5	2.9
Copper	45.4	15.5	60.6	27.7	39.5	19	73	27.3	22.7	7.15	21.2	11
Iron	26,300	6,140	32,800	11,996	34,300	12,960	66,200	21,896	17,100	3,837	9,990	4,733
Lead	59.5	32.5	60.5	33.7	29	23.7	29.1	25.9	27	23.1	29	24.6
Lead (2)	32.9	12.9	82.2	33.8	36	24.6	58.2	18.1	8.2	3.52	37.3	20.6
Manganese	482	116	912	341	536	380	1670	679	155	47.2	151	66.6
Mercury (3)	0.2	0.11	0.2	0.11	0.1	0.1	0.29	0.11	0.1	0.1	0.1	0.1
Molybdenum	60.4	13	6	5.07	6	5.28	6	5.21	16.7	7.98	6	5.03
Nickel	21.3	10.8	45.5	13.4	14.1	9.51	59.9	20.6	9.5	8.74	17.5	10.7
Selenium	40	22.7	31	19.2	31	21.8	31	21	31	26	31	18.8
Selenium (2)	1.3	0.77	1.9	1.13	0.5	0.5	21	0.97	0.5	0.5	0.5	0.5
Silver	7	2.91	2.5	1.85	2.5	2	2.5	1.94	2.5	2.25	2.5	1.83
Strontium	262	136	411	190	136	104	348	253	457	268	40.6	26.2
Thallium	288	78	66.8	45.4	66.5	47.5	66.5	47.6	66.5	55.5	66.5	41.4
Thallium (2)	1	0.57	3	0.68	0.5	0.5	4.2	1.26	0.5	0.5	1.5	1
Vanadium	59.9	15.3	91.3	32.2	84.4	31.2	160	49.2	45.7	12.5	26.3	14.3
Zinc	346	103	658	342	280	203	473	188	107	41.7	221	146
INORGANICS (mg/L)												
Calcium	39.2	26.4	60.6	34.6	19.8	18.1	47.1	34.5	73.4	44.3	6.61	5.31
Magnesium	8.15	5.1	13.7	7.62	8.09	5.15	22.1	11.9	14.7	9.26	2.98	1.75
Potassium	6.8	4.68	8.09	4.81	7.21	4.36	13.2	5.75	5.65	4.1	4.18	2.54
Sodium	39.6	18.6	44.6	17.3	24.9	17.8	141	85.5	37.2	22.3	6.55	3.63
Alkalinity	142	59.5	172	78.9	54.4	43.8	86.1	61.1	156	113.3	12.2	8.6
Sulfate	25.9	6.66	38.4	14.3	11	6.72	23	12.2	63.1	24.8	4.85	3.9
Chloride	68	29.6	172	47.9	120	57.3	297	178	123	72	3.95	3.01
Fluoride	0.71	0.26	0.51	0.24	0.35	0.23	1.3	0.33	0.48	0.32	0.27	0.26
pH	8.1	7.6	8	7.5	7.9	7.3	7.9	7.4	8.1	7.8	7.6	6.9
Specific Conductance	540	216	560	311	260	203	1,040	709	770	402	100	70
Dissolved Solids	271	153	470	224	184	131	582	394	474	273	102	58
Total Suspended Solids	570	200	1,232	402	568	380	1,659	505	384	94	219	90
Ammonia as N	0.32	0.1	1.7	0.35	0.26	0.11	0.5	0.09	0.1	0.04	0.1	0.06
Nitrate/Nitrite as N	1.76	0.97	1.82	1.28	1.22	0.99	0.84	0.63	1.2	0.74	0.61	0.39
Total Phosphorus as P	0.54	0.28	1.44	0.54	1.1	0.68	0.86	0.35	0.84	0.07	0.06	0.03

NOTES:

Hydrograph events were sampled with automatic samplers at the beginning of the storm runoff at preset time intervals until the stream-channel stage declines to Data reported in the NPDES Permit Application Monitoring Report for RFP (ASI 1993).

(1) All storm water quality metals data are total recoverable concentrations.

(2) Analytical method used was graphite furnace atomic absorption spectroscopy.

(3) Analytical method used was cold vapor atomic absorption spectroscopy.

ABBREVIATIONS:

ASI = Advanced Sciences, Inc.
mg/L = milligrams per liter
pCi/L = picoCuries per liter
µg/L = micrograms per liter

A qualitative review of Tables 5-6 and 5-7 does not indicate any large differences between the quality of water from sampling areas where all or a majority of the drainage area is in the Industrial Area (51 to 100 percent), such as SW022, SW023, and SW093, as compared to sampling areas where only a portion of the drainage area is the Industrial Area (8 to 19 percent), such as SW027, SW118, and SW998. (See Table 5-1.)

For storm water event samples, maximum and average concentrations for many of the trace metals and major ions analyzed were higher in first-flush samples than with hydrograph-integrated samples with the exception of SW023 and SW027. When comparing site-by-site average hydrograph integrated concentrations, each site exhibited a varying number of cases when relatively high concentrations were reported. More detailed conclusions as well as fairly extensive data summaries by monitoring location in both tabular and graphic form may be found in the 1993 ASI report.

Quality-flow patterns were evaluated for selected storm runoff events. Variations of specific conductance as a function of discharge occasionally exhibited an erratic pattern; however, in several instances, a more normally expected dilution pattern of lower specific conductances with higher discharges as well as hysteresis effects during given hydrographs were noted. Thus, dilution and hysteresis effects are neither consistent in pattern for any given storm event at all sites nor are trends apparent on a storm-after-storm basis.

5.4 PATHWAY IDENTIFICATION

Decisions affecting the surface water monitoring plan in the Industrial Area must take into account the surface water flow pathways that drain the Industrial Area. All potential surface water pathways into the Industrial Area have been identified and diverted. A number of distinct pathways have been identified for the Industrial Area. These pathways are distinguished by the drainage destination associated with the surface water drainage networks, which are comprised of a number of subbasins. Subbasins are

hydrologically distinguishable areas that drain storm water to a distinct location or locations. The flow pathways and subbasins are shown in Figure 5-2. The drainage pathways link the subbasins as they drain toward a common destination. The Industrial Area subbasins have been identified in Section VII of the *RFP Drainage and Flood Control Master Plan*, prepared for EG&G by Wright Water Engineers in April 1992 (Wright Water Engineers 1992). The same subbasin identification that was used in the *Drainage and Flood Control Master Plan* will also be used in this document. The *Drainage and Flood Control Master Plan* (Wright Water Engineers 1992) divides the Industrial Area into 29 subbasins, each of which was given a designator that begins with a "C." The letters following the "C" designate the stream to which the basin ultimately drains; "WA" indicates North Walnut Creek, and "SWA" indicates South Walnut Creek. "DIV" refers to a diversion, either the SID or the Walnut Creek Diversion.

This analysis considers only Industrial Area surface water flow pathways resulting from usual flow conditions. Alternate pathways may occur when storm sewers and culverts are overwhelmed by excessive runoff. Also, the hydrologic condition and carrying capacity of storm sewers and culverts vary within the Industrial Area. A total of seven drainage pathways, or seven unique destinations, have been identified for runoff draining the Industrial Area under normal flow conditions. For the most part, these drainage paths link the subbasins, which drain to the six storm water NPDES monitoring stations. The interceptor trench system (ITS) located north of the Solar Ponds (OU4) is also included as a pathway. This ITS system was installed to protect North Walnut Creek from groundwater contamination present in the Solar Ponds (OU4) area. The ITS system primarily collects groundwater, although some surface water runoff and seep flows are also collected. The destination of this ITS water is storage in tanks and eventual treatment as detailed in the IM/IRA for OU4; therefore, this water lies outside surface water monitoring of concern to this IM/IRA. The pathways, destinations, and the NPDES monitoring station associated with the pathways are identified in Table 5-8 and shown in Figure 5-2.

TABLE 5-8
Industrial Area IM/IRA/DD
Pathways, Destinations, and the Associated
NPDES Storm Water Monitoring Station
and/or RFP Gaging Station

Pathway	Destination	Current Monitoring Station
1	Pond B-5	SW022
2	South Walnut Creek	SW022/GS10
3	North Walnut Creek	SW093 and SW118
4	McKay Diversion Canal	SW998
5	Pond C-2 via South Interceptor Ditch	SW027
6	A-Series Ponds	GS13
7	Interceptor Trench (Groundwater Collection System)	Not part of the surface water monitoring program

5.4.1 Pathways and Subbasins

The following sections discuss each of the seven pathways. Each section contains two tables: the first defines the drainage area characteristics, and the second provides detail concerning the location of the drainage point relative to each of the individual subbasins. The pathway drainage pattern tables list the subbasins within each pathway in upstream to downstream order, the major buildings within the subbasins, and the total acreage of the area drained. In some cases, a second destination subbasin is listed when a variable pathway can exist because of the limited ability of the primary pathway to convey all runoff. The second table in each section identifies the point for each subbasin at which flow leaves that subbasin. These physical flow structures represent the point at which monitoring for a subbasin can be conducted.

5.4.2 Pathway 1

Pathway 1 drains to Pond B5 from subbasin CSWAA6. Much of the Industrial Area that is south of Central Avenue is tributary to Pathway 1. The subbasins, drainage area, and drainage area characteristics are outlined in Table 5-9. Table 5-10 describes the locations of the subbasin drains.

TABLE 5-9
Industrial Area IM/IRA/DD
Pathway 1 Drainage Area Characteristics

Subbasin	Major Buildings in Subbasin	Drainage Area (acres)	Drains to	Overflows to
CSWAA2	122, 123, 124, 125, 441, 443, 442, 452	13	CSWAA4	
CSWAA3	439, 440 (northeast), 444, 445, 447 (east), 448, 463, 668	12	CSWAA4	
CSWAA4	221, 224, 275, 662, 663, 664	16	CSWAA5	
CSWAA5	865, 866, 883 (north), 884, 886, 888, 889, 880	28	CSWAA6	
CSWAA6	NONE	15	Pond B-5 (SW022)	CSWAB5

TABLE 5-10
Industrial Area IM/IRA/DD
Outlets from Each Subbasin in Pathway 1

Subbasin	Location of Subbasin Drain
CSWAA2	A 21-inch CMP located in the northeast corner of subbasin CSWAA2
CSWAA3	A ditch at the northeast corner of subbasin CSWAA3
CSWAA4	An 18-inch CMP culvert located in the northeast corner of subbasin CSWAA4
CSWAA5	A 24-inch CMP under Central Ave. located near the northeast corner of subbasin CSWAA5
CSWAA6	Two culverts, a 30-inch RCP and a 30-inch CMP, drain the northeast corner of CSWAA6 and empty to a channel east of the Industrial Area that drains to Pond B-5

CMP = corrugated metal pipe
RCP = reinforced concrete pipe

5.4.3 Pathway 2

Pathway 2 drains to South Walnut Creek from subbasin CSWAB5. Subbasins that are tributary to Pathway 2 lie in the east-central portion of the Industrial Area. The drainage area characteristics and outlier locations for subbasins in Pathway 2 are described in Tables 5-11 and 5-12, respectively.

TABLE 5-11
Industrial Area IM/IRA/DD
Pathway 2 Drainage Area Characteristics

Subbasin	Major Buildings in Subbasin	Drainage Area (acres)	Drains to	Overflows to
CSWAB1	223, 333 (south), 334 (south), 549, 551 (east), 552, 553, 554, 555, 558	30	CSWAB5	
CSWAB2	NONE	6	CSWAB3	CSWAB4
CSWAB3	559 (southeast), 561 (south), 564, 707, 708, 750, 776 (southeast), 777 (south), 778 (east), 980	31	CSWAB5	CSWAB
CSWAB4	965, 968, 984, 985, 989 990 991, 996	19	CSWAB5	
CSWAB5	987, 988, 993, 995	15	South Walnut Creek (SW023)	

TABLE 5-12
Industrial Area IM/IRA/DD
Outlets from Each Subbasin in Pathway 2

Subbasin	Location of Subbasin Drain
CSWAB1	A 72-inch CMP storm sewer located at ponded area at east end of subbasin CSWAB1
CSWAB2	A 4-foot by 3-foot elliptical CMP storm sewer located southeast of Building 707, near the middle of subbasin CSWAB2
CSWAB3	A 60-inch CMP storm sewer located at the eastern end of subbasin CSWAB3
CSWAB4	A 54-inch-diameter culvert located at the eastern end of subbasin CSWAB4
CSWAB5	Two culverts, both 30-inch RCP, located at the eastern end of subbasin CSWAB5

5.4.4 Pathway 3

Pathway 3 drains the north end of the Industrial Area to North Walnut Creek. Of the 8 acres comprising subbasin CWAC7, only approximately 2 acres drain to Pathway 3, the area north of the ITS collection system. Runoff from areas south of the ITS collection system drains north; surface water flow is effectively captured by the ITS system for separate storage and treatment in accordance with the OU4 IM/IRA. Tables 5-13 and 5-14 summarize the drainage characteristics and outfall locations of Pathway 3.

5.4.5 Pathway 4

Pathway 4 drains subbasin CWADIV2 to the McKay Diversion Canal. This canal drains to the Walnut Creek Diversion Canal, which flows around the north end of the Industrial Area. The areas tributary to Pathway 4 have relatively little industrial development. Most of the developed area on this pathway consists of engineering and administrative buildings, but a warehouse and a material storage yard are associated with Building 130. No other industrial operations are associated with this pathway.

TABLE 5-13
Industrial Area IM/IRA/DD
Pathway 3 Drainage Area Characteristics

Subbasin	Major Buildings in Subbasin	Drainage Area (acres)	Drains to	Overflows to
CWAC12	119, 127, 128	9	CWAC1	
CWAC1	111, 112, 113, 115, 335	17	CWAC13	
CWAC11	331, 333 (north), 334 (north), 551 (west)	9	CWAC13	
CWAC13	NONE	3	CWAC3	
CWAC10	559 (except southeast), 561 (north), 776 (west), 778 (west)	9	CWAC3	
CWAC3	371, 374, 516, 517, 518	26	North Walnut Creek	CWAC4
CWAC2	367	18	CWAC5	
CWAC5	NONE	10	North Walnut Creek	CWAA1
CWAC4	262, 373, 376, 790	10	North Walnut Creek	
CWAC6	701, 712, 713, 770, 771, 774, 776 (northeast), 777 (northwest)	10	CWAC7	
CWAC7	NONE	8	North Walnut Creek	CWAA1
CWAA1	NONE	15	North Walnut Creek	

TABLE 5-14
Industrial Area IM/IRA/DD
Outlets from Each Subbasin in Pathway 3

Subbasin	Location of Subbasin Drain
CWAC12	Three storm sewer outfalls flowing north under the northern edge of CWAC12 drain the subbasin to a ditch running through CWAC1.
CWAC1	Ditch north of Sage Ave. drains to CWAC13 at the eastern end of CWAC1.
CWAC11	Two culverts, an 18-inch CMP and an 8-inch CMP, are located at the northeast corner of subbasin CWAC11.
CWAC13	A 64-inch CMP culvert is located at the north end of CWAC13.
CWAC10	An 18-inch CMP culvert located along the northwestern boundary of CWAC10 drains to the channel that runs through CWAC3; also a 14-inch CMP crosses the subbasin boundary under the intersection of Sixth St. and South 71 Dr.
CWAC3	A 48-inch CMP culvert is located near the northeast corner of subbasin CSWA3. This sewer drains directly into the 72-inch storm sewer that empties into North Walnut Creek.
CWAC2	A 54-inch CMP storm sewer is located at northern end of CWAC2.
CWAC5	A 72-inch CMP storm sewer carries flow from east end of CWAC5 to North Walnut Creek.
CWAA1	A 36-inch-diameter culvert located at north end of CWAA1 drains to North Walnut Creek.
CWAC4	An 8-inch-diameter PVC storm sewer is located at the northeast corner of subbasin CWAC4.
CWAC6	An 18-inch CMP culvert is located at the northeast corner of CWAC6.
CWAC7	Only a portion of CWAC7 drains to N. Walnut Creek. The flow that enters from CWAC6 and the flow contributing north (or downgradient) of the Interceptor Trench System will flow through the 60-inch-diameter storm sewer at the north end of CWAC7. This sewer connects to the 72-inch storm sewer that drains to North Walnut Creek.
CWAA1	A 36-inch culvert located at the center of the northern boundary of the CWAA1 drains the subbasin to North Walnut Creek.

The drainage area characteristics for Pathway 4 are summarized in Table 5-15. Table 5-16 gives the locations of the subbasin drain for Pathway 4.

TABLE 5-15
Industrial Area IM/IRA/DD
Pathway 4 Drainage Area Characteristics

Subbasin	Major Buildings in Subbasin	Drainage Area (acres)	Drains to	Overflows to
CWADIV2	130, 131	29	McKay Diversion Canal	CWAC2

TABLE 5-16
Industrial Area IM/IRA/DD
Outlets from Each Subbasin in Pathway 4

Subbasin	Location of Subbasin Drain
CWADIV2	A 36-inch CMP culvert located at the northern end of CWADIV2 that drains to the McKay Diversion Canal

5.4.6 Pathway 5

Pathway 5 is a collection of drains that drain from the southern end of the Industrial Area to subbasin DIV3 and eventually to the SID. The Building 881 area is part of subbasin DIV3. Hydrologically, the area around the buildings drains toward the south and down the 881 Hillside toward the SID, as does the rest of subbasin DIV3. The drainage area characteristics and outlet locations for the subbasins in Pathway 5 are outlined in Tables 5-17 and 5-18, respectively.

TABLE 5-17
Industrial Area IM/IRA/DD
Pathway 5 Drainage Area Characteristics

Subbasin	Major Buildings in Subbasin	Drainage Area (acres)	Drains to	Overflows to
CDIV1	440 (except northeast), 447 (west), 448, 451, 460	14	DIV3	CSWAA3
DIV3	850, 881, 883 (south), 885, 887		SID	

TABLE 5-18
Industrial Area IM/IRA/DD
Outlets from Each Subbasin in Pathway 5

Subbasin	Location of Subbasin Drain
CDIV1	A 36-inch-diameter culvert drains the storm sewer network, south of Building 460; the storm sewers daylight on the hillside south of Building 664 into the SID.
DIV3	Drainage in the vicinity of Buildings 850 and 881 drains to the south. The Building 881 footing drain is collected and diverted to the OU1 treatment facility.

5.4.7 Pathway 6

Pathway 6 drains two subbasins located in the northeast quadrant of the Industrial Area to the A-series ponds. Tables 5-19 and 5-20 summarize the drainage area characteristics and outfall locations for the subbasins included in Pathway 6.

TABLE 5-19
Industrial Area IM/IRA/DD
Pathway 6 Drainage Area Characteristics

Subbasin	Major Buildings in Subbasin	Drainage Area (acres)	Drains to	Overflows to
CWAB1	964	7	CWAB2	
CWAB2	NONE	4	A-series Ponds	

TABLE 5-20
Industrial Area IM/IRA/DD
Outlets from Each Subbasin in Pathway 6

Subbasin	Location of Subbasin Drain
CWAB1	A 48-inch-diameter culvert drains CWAB1 toward the northeast into CWAB2.
CWAB2	A 48-inch CMP culvert drains CWAB2 toward the northeast into a channel leading to the A-series ponds.

5.4.8 Pathway 7

Pathway 7 represents the northeast quadrant of the Industrial Area that is currently being collected by the ITS system. The water collected by the ITS system is stored in tanks north of the Industrial Area and eventually treated in either the OU4 evaporators or at Building 374. Surface water runoff from the portions of subbasin CWAC7 (around 6 acres) upgradient from the ITS flows into the ITS. Also, some groundwater flow beneath subbasins CWAA1 and CWAB2 is collected by the french drain network. Subbasin CWAC8 is comprised of the Solar Evaporation Ponds and their immediate vicinity. If precipitation falls within the lined Solar Ponds themselves, it is naturally evaporated or treated in either the OU4 IM/IRA treatment system or in Building 374.

Precipitation falling immediately outside the lining of the Solar Ponds infiltrates the soils and is probably collected by the ITS system or becomes surface water runoff, which is collected by the ITS system. Precipitation falling in subbasin CWAC8 (the Solar Ponds) is collected and sent to the Building 374 treatment facility. Table 5-21 shows the drainage characteristics for the subbasins located in Pathway 7. Subbasin drain locations are described in Table 5-22.

TABLE 5-21
Industrial Area IM/IRA/DD
Pathway 7 Drainage Area Characteristics

Subbasin	Major Buildings in Subbasin	Drainage Area (acres)	Drains to	Overflows to
CWAC9	215, 705, 706, 729, 777 (northeast), 779, 782, 928, 966	6	CWAC7	CSWAB3
CWAC8	788, Solar Ponds 207A, 207B, 207C	10	Infiltration/ITS	N/A
CWAC7	NONE	8	ITS	

TABLE 5-22
Industrial Area IM/IRA/DD
Outlets from Each Subbasin in Pathway 7

Subbasin	Location of Subbasin Drain
CWAC9	An 18-inch CMP storm sewer that drains CWAC9 between the 207A and 207C Solar Ponds and daylights on the hillside just north of the Solar Ponds
CWAC8	Not hydrologically connected to Industrial Area drainage patterns. Precipitation falling in subbasin CWAC8 is collected and sent to the Building 374 treatment facility.
CWAC7	The portion of CWAC7 upgradient from the ITS flows into the ITS.

5.4.9 Industrial Area Buildings

Table 5-23 references the major industrial area buildings to the pathways identified in Sections 5.4.2 through 5.4.8. Surface water runoff resulting from precipitation falling on or in the vicinity of the building will drain to the pathway indicated. In some instances, a boundary for a drainage subbasin passes through a building. In these instances, that portion or quadrant of the building that contains flows along a particular pathway is identified.

5.4.10 Foundation Drains

Foundation drains are of particular concern in the Industrial Area because of their potential for transporting contamination. These drains are found under and around building foundations and are used to control groundwater levels to prevent basement flooding. Waters from foundation drains often flow into the storm drain system or directly into the environment as surface water flow. Although surface water flow from the immediate vicinity of a building may follow a particular pathway out of the Industrial Area, foundation drain flows for that building may be conveyed by pipes to another subbasin and, thus, to another pathway. Section 7.0 of this IM/IRA/DD provides additional details on foundation drains including monitoring and sampling locations and foundation drain flow patterns. The foundation drains and their subsequent flow pathways, as currently understood, are identified in Table 5-24.

5.5 EVALUATION OF MONITORING PROGRAM AND DATA GAPS

The existing surface water monitoring program was evaluated to determine whether it could meet the objectives of this IM/IRA. Generally stated, the purpose of this project is to conduct environmental monitoring in a manner sufficient to help ensure that releases to the environment from decontamination and decommissioning activities, or other nonroutine activities, are identified. It is of primary importance to identify these releases

TABLE 5-23
Industrial Area IM/IRA/DD
Cross-Reference of Major Buildings to Pathways

Building	Pathway
111	3
112	3
113	3
115	3
119	3
122	1
123	1
124	1
125	1
127	3
128	3
130	4
131	4
207	7
215	7
221	1
223	2
224	1
262	3
275	1
331	3
333 (north)	3
333 (south)	2
334 (north)	3
334 (south)	2
335	3
367	3
371	3
373	3
374	3
376	3
439	1
440 (except northeast)	5
440 (northeast)	1
441	1
442	1
443	1
444	1
445	1
447 (east)	1

Building	Pathway
447 (west)	5
448	5
451	5
452	1
460	5
463	1
516	3
517	3
518	3
549	2
551 (east)	2
551 (west)	3
552	2
553	2
554	2
555	2
558	2
559 (except southeast)	3
559 (southeast)	2
561 (south)	2
561 (north)	3
564	2
662	1
663	1
664	1
668	1
701	3
705	7
706	7
707	2
708	2
712	3
713	3
729	7
750	2
770	3
771	3
774	3
776 (southeast)	2

Building	Pathway
776 (west and northeast)	3
777 (south)	2
777 (northeast)	7
777 (northwest)	3
778 (east)	2
778 (west)	3
779	7
782	7
788	7
799	3
850	5
865	1
866	1
880	1
881	5
883 (south)	5
883 (north)	1
884	1
885	5
886	1
887	5
888	1
889	1
928	7
964	6
965	2
966	7
968	2
980	2
984	2
985	2
987	2
988	2
989	2
990	2
991	2
993	2
995	2
996	2

TABLE 5-24
Industrial Area IM/IRA/DD
Foundation Drains and Pathways

Building	Foundation Drain	Surface Water Pathway	Build-ing	Foundation Drain	Surface Water Pathway
111	FD-111-1	3	774	FD-774-1, FD-774-2, FD-774-3	3
371/374	FD-371-1, FD-371-2, FD-371-3	3	779	FD-779-1	7
517/518	FD-371-4, FD-371-5, FD-371-6	3			
371 Condensate from Utility Lines Near Building 371	FD-371-MC	3	850	FD-850-1	5
444, 447	FD-444/460	5	865	BS-865-1, BS-865-2	Collected for treatment in Building 374
559, 561	FD-516-1	3 (Foundation drain discharge discontinued in March 1993)	881	FD-881-1	Collected for treatment in OU1 treatment facility
559, 561	FD-559/560	Sent to STP for treatment	883	FD-883-1	1
707	BS-707-1, BS-707-2, BS-707-3	2	886	FD-886-1, FD-886-2	Collected for treatment in Building 374
771	FD-771-1	3	991	FD-991-1	Not verified

at the fenceline of the Industrial Area, but it is also desirable to identify these releases as close to the source as possible. Because the existing programs were designed to meet other specific regulatory requirements, they may not be suited to these objectives. Similar to Section 5.3, the evaluation of the surface water monitoring program is

logically separated into two general categories: evaluation of the monitoring of base flow conditions and the monitoring of storm flow conditions. Only through adequate characterization of both general categories of flow can a complete characterization of surface water be achieved. As previously discussed, the current program for surface water quality characterization emphasizes water quality in the drainage ponds.

Monitoring base flow quality allows detection of releases to groundwater that ultimately discharges to surface water and of spills directly to surface water. Spills to surface soils or pavement exposed to rainwater are likely to be detected in particulates carried during storm events, making monitoring of storm water an essential part of this project.

5.5.1 Base Flow Conditions

A considerable amount of data for base flow surface water conditions has been generated and analyzed at RFP, as described in Section 5.3.1 of this report. These data were instrumental in identifying contaminated seeps that are currently being separately collected and treated under an IM/IRA.

Based on the goals and objectives of this IM/IRA, the following are identified as data or monitoring gaps pertinent to surface water base flows within the Industrial Area:

- The surface water characterization program within the Industrial Area is largely inactive. Data that would be useful in identifying releases from the Industrial Area are not routinely generated.

- The existing characterization data for surface water within the Industrial Area are insufficient to predict the identification of contaminants in surface water. For instance, contaminants may only be detected in seeps during moist periods when alluvial groundwater rises into a contaminated IHSS location upgradient of the seep. This seasonal effect has not been adequately investigated.

- Surface water base flows within the Industrial Area are not sufficiently quantified to date; this includes discharge rates. Attempts to quantify these base flows have been made, but have resulted in estimates that require further verification.

- The range of base-line quality variations in base flows needs to be identified on a sampling point by sampling point basis. These data exist within the 1989 and 1990 Surface Water and Sediment Geochemical Characterization reports (EG&G 1992k; EG&G 1992l), but the evaluation presented within the reports groups several sampling locations making it difficult to assess water quality at individual points. The groups were defined based on geographic location or proximity to an OU. The continuing generation of additional data useful in this evaluation is also necessary.

- Establishment of surface water sampling stations, with the exception of the six NPDES storm water sampling stations, was not based on an evaluation of drainage basins and subbasins. Thus, even for those drainage subbasins within which base flows occur, there are little or no data on the quality of water leaving those subbasins. Such data are critical to establishing base-line water quality before conducting nonroutine D&D activities in each subbasin.

- Establishment of an overall mass balance of pollutant loading to the drainage basins and drainage ponds has not been attempted. There has been no quantification of the percentage of total pollutants transported by base flows as opposed to the percentage transported by storm water flows.

- An overall mass balance of pollutant loading on a drainage basin and subbasin basis should be developed for base flow transport of contaminants. This mass balance should particularly address VOCs that are likely to be identified in the flow from seeps and springs.

The following section addresses the evaluation of the storm water sampling and characterization program as it pertains to D&D activities or other nonroutine activities.

5.5.2 Storm Water

A considerable amount of data for storm water, including all storm water leaving the Industrial Area, has also been generated and analyzed at RFP. These data include a wide range of analytes. The overall results of the programs pertinent to this IM/IRA are presented in Section 5.3.2 of this report. These data were primarily generated in support of the NPDES storm water permit application, which was submitted in October 1992. It is anticipated that the NPDES storm water permit, when issued, will not include any numeric water quality criteria. Currently, the storm water data being generated are primarily focused on radionuclide and metal transport data. Further, some of the six NPDES storm water sampling stations are not actively monitored currently.

Based on the current situation, the following data gaps are identified pertinent to storm water flows within the Industrial Area:

- Some of the six NPDES storm water stations sample storm water that could be considerably diluted with non-Industrial Area flows. For example, station SW093 captures runoff from an area in which only 50 percent of the total basin area is comprised of the Industrial Area. Thus, detection of releases at some of these stations may be difficult because of excessive dilution of contaminants.

- Very little VOC data are available for storm water, partially because of the logistics involved in collecting high quality, manual "grab" samples during storm events.

- Radionuclides are not consistently tested for, nor have careful and detailed characterization activities for isotope-specific analyses been conducted for all isotopes of interest at locations near the Industrial Area boundary.

- Base-line conditions and variations in storm water quality for all analytes on the TCL list have not been conducted.

- The available data are not sufficient to establish a predictive capability related to storm water quality. (For example, data are insufficient to establish the smallest storm event in which radionuclides become entrained in storm water leaving the Industrial Area.)

- Establishment of an overall mass balance of pollutant loading to the drainage basins and drainage ponds has not been attempted. There has been no quantification of the percentage of total pollutants transported by storm water flows.

- No attempt has been made to trace contaminants identified in storm water in a drainage basin back to specific sources.

- No subbasin-specific storm water monitoring has been performed in the Industrial Area.

- Storm water quality data do not exist to characterize the first flush of contaminants from a drainage subbasin as well as the hydrograph-integrated transport of contaminants from a drainage subbasin. Significant transport of contaminants can occur with the first flush, which is the first 30 minutes of storm runoff or high flow. However, these data do exist for the larger drainage basins.

- In reviewing the existing storm water data, there is a lack of flow data. This information is essential in any mass balance calculations to estimate quantities of water that may need to be treated.

5.6 SURFACE WATER MONITORING TECHNOLOGIES ASSESSMENT

The goal of the surface water monitoring technologies assessment is to identify new technologies and instrumentation to sample and measure surface water for compliance with water quality standards and the collection of base-line surface water quality data.

The review and evaluation of new technologies was performed to identify and evaluate new technologies that monitor, detect, and respond to potential releases of constituents to surface water at RFP. The assessment approach considered future D&D monitoring activities and requirements. The two primary monitoring requirements addressed were real-time monitoring and environmental levels of sensitivity. These technologies were specifically researched for each monitoring parameter.

Real-time monitoring instruments with the capability to detect surface water parameters at environmental levels were of primary interest during this evaluation. Environmental levels are considered to be subpicocuries per liter in water for radiological parameters and milligrams per liter (mg/L) and μg/L in water for nonradiological parameters.

The efforts of this assessment determined that no commercially available real-time analytical methods or instrumentation are available to directly monitor radiochemistry at environmental levels in water. For the purposes of this assessment, only nonradiological monitoring instruments were evaluated. The priority of this assessment was placed on improvements to existing instruments currently supporting the RFP surface water monitoring program. Table 5-25 shows the current monitoring systems and recommendations for surface water monitoring technologies for RFP. The current monitoring systems are adequate surface monitoring technologies. Recommendations are

TABLE 5-25
Industrial Area IM/IRA/DD
Surface Water Monitoring Technologies

Current Monitoring System	Recommendations	Rationale
Real-Time Radio Telemetry Monitoring	Adequate. Update multiprobe instrument to include turbidity sensor, data logging, and programmability.	Decrease number of instruments needed to lower potential downtime and increase reliability.
Automated Surface Water Sampling	Adequate.	No advantages identified from the evaluation of alternative instrumentation.
Field Parameter Sampling	Adequate.	No advantages identified from the evaluation of alternative instrumentation.

provided as possible upgrades and should be evaluated further to determine their applicability and cost effectiveness.

The review and evaluation of new technologies was approached in the following step-by-step manner:

1. Gain an understanding of the current monitoring programs and identify basic monitoring goals, including the development of technologies assessment criteria.

2. Determine the specific monitoring instruments and technologies currently used by the environmental programs at RFP.

3. Obtain environmental technologies information from personnel at RFP and other DOE facilities involved with the environmental monitoring programs.

4. Contact the manufacturers of the current instrumentation and determine available upgrades to existing RFP instruments and the benefits achieved from the upgrades.

5. Contact other manufacturers of similar instrumentation to evaluate technologies and compare to current RFP instrumentation performance.

6. Determine research and development (R&D) technologies available and information contacts.

7. Evaluate information obtained from assessment and develop recommendations.

This assessment identified literature concerning current and possible future systems, databases, technology information transfer programs, and the strengths and limitations of current and new technologies.

Existing DOE facilities located in Fernald, Ohio, and Weldon Spring, Missouri, that have radiological and nonradiological environmental monitoring requirements similar to RFP were contacted to ascertain technologies and instruments used for monitoring at other DOE facilities. Generally, these facilities were using similar technologies and instruments for their monitoring activities.

Several DOE sources of R&D technologies were also discovered including (1) Environmental Technologies Group at RFP, contact Tom Rising; (2) Los Alamos National Laboratories (LANL), Technologies Group, contact Joyce Shroeder; and (3) Nevada Field Office, Office of Technology Development, contact Lee Ziegler of EG&G. Other private sector R&D innovative technologies sources appear to be available

including engineering departments of major instrument manufacturers and educational institutions.

The majority of the manufacturers and/or vendors of environmental surface water monitoring instruments currently used at RFP were also contacted to determine the most recent upgrades and improvements to the existing monitoring instrumentation. New technologies were evaluated if they were available and met the assessment criteria stated in Section 9.4.

The following four surface water programs (and related monitoring instruments) were studied at RFP during the technologies assessment:

- regulatory compliance monitoring;
- routine operational monitoring;
- routine site-wide surface water monitoring; and
- site-wide storm event monitoring.

These programs monitor surface water quality for both radiological and nonradiological surface water quality parameters.

The technologies and instrumentation related to the four surface water programs previously listed are currently used interchangeably within each individual surface water monitoring program. Therefore, for the purposes of this assessment, general technologies and instrumentation common to the four surface water programs are presented.

New technologies in the R&D stages were also reviewed, but not evaluated because of lack of availability. R&D technologies for real-time monitoring at environmental levels of nonradiological parameters in surface water do exist. However, these technologies

require more evaluation to determine their applicability, cost effectiveness, and reliability.

New technologies in the R&D stages were reviewed but not evaluated since these technologies and instrumentation used are not currently available commercially.

Elements of the surface water program not addressed in this assessment include (1) sediment sampling, (2) building water taps, and (3) monitoring of groundwater seeps. Surface water programs related to the waste treatment plant and biological constituents were reviewed but not evaluated to make recommendations.

The sample collection and monitoring instrumentation used for the four surface water monitoring programs discussed earlier include (1) real-time radio telemetry, (2) automated sampling, and (3) field parameter sampling.

5.6.1 Real-Time Radio Telemetry Monitoring

Radio telemetry stations are used to record real-time water quality parameters at 12 monitoring stations located within the RFP boundary, two of which are positioned within the Industrial Area. The telemetry surface water monitoring network combines real-time monitoring sensors with bidirectional radio-based transmissions systems and data processors. The radio telemetry stations are capable of receiving instructions and transmitting data.

The radio telemetry monitoring stations are portable and are solar powered. Solar power specifications require monitoring instruments to have low voltage and low current. Siting of the units is limited only by line of sight of the radio telemetry repeater tower.

Currently, RFP uses a combination of water quality sensors, transducers, and turbidimeters at each radio telemetry monitoring station to monitor 11 surface water quality parameters and water flow.

RFP uses the Hydrolab Model H20 Multiprobe for nonradiological water quality measurements at selected radio telemetry monitoring stations. The H20 multiprobe is a multiparameter water-quality monitoring system capable of providing real-time measurements of 10 water-quality parameters: temperature, dissolved oxygen, percent dissolved oxygen saturation, specific conductance, salinity, conductivity, resistivity, TDS, pH, and redox.

Real-time turbidity measurements are performed at each station using a separate turbidimeter instrument manufactured by the Hach Company.

Water depth and flow rate measurements are performed by transducers and electronic flow meters. Pressure transducers manufactured by Druck, Model PTX-161/D, are used to measure water depth in free-standing water bodies, and electronic flow meters manufactured by ISCO measure flow rates through various flow-control devices, including flumes, weirs, and culverts. Some flumes are enclosed in structures designed for year-round measurement. Water depth and flow rate measurements provide the capability of calculating constituent mass balances to assess constituent fate and transport.

Currently, the real-time radio telemetry network uses controllers manufactured by Bristoll Babcock combined with data recorders manufactured by Moore Industries to record data and operating parameters.

The specific criteria used to assess new equipment for surface water radio telemetry systems included weather resistance, low maintenance, high accuracy at low detection levels, reliability, and ease of calibration. New or improved equipment available has expanded capabilities over current instrumentation. The ability to measure turbidity, data

logging, and programmability has been added to recent commercially available multiprobe monitors including the H20 multiprobe. These improved capabilities may allow the use of only one monitoring probe to perform the current water quality measurements. These capabilities may increase sample collection quality (i.e., reliability) and decrease maintenance efforts.

The instrumentation and the radio telemetry system used at RFP were determined to be more than adequate for the current surface water monitoring objectives. Recommendations for upgrading the instruments should be more fully evaluated to determine their applicability. Assessment of instrumentation related to D&D activities is discussed in Section 9.4.

5.6.2 Automated Surface Water Sampling

Thirteen stream gaging stations in the RFP buffer zone are equipped with automated sampling equipment (EPA 1993a). Surface water samples are collected and laboratory-analyzed for suspended sediment, total metals, total radionuclides, and organic constituents. Flow rates through flumes, weirs, and culverts are also measured at automated surface water stations.

Automated sampling instrumentation are used at stream gaging stations to collect water quality samples at specific time intervals (EG&G 1993k). These samplers are equipped with a peristaltic pump that pumps water from a sampling tube anchored to the stream bed or flow control structure. The samplers are programmable so samples may be collected during specific periods of time or stream stages. The automated monitoring stations at RFP are mainly configured to collect composite samples during a storm water event. The sampling interval is selected based on the local drainage basin characteristics and programmed to collect samples at the initial rise in stage through the top of the basin's characteristic hydrograph. These samplers are particularly useful for obtaining snowmelt and storm-event related samples, as well as time-weighted composite samples.

Three models of automated samplers are currently being used at RFP, all manufactured by ISCO: Model 2700 portable, Model 3700 portable, and Model 3700R refrigerated. Two types of flowmeters are used for the automated samplers: ISCO models 3220 and 3230. The meters also have data logging capabilities to record the stream stage and sample interval. Each station has a flow structure (i.e., weir, flume, culvert). The automated samplers are easy to disassemble and relocate; however, the flow structures are more permanently installed structures. The monitoring stations are powered by a combination of battery packs, alternating current power lines, and solar panels. Several of the gaging stations are part of the radio telemetry system and are capable of transmitting data that are recorded on the flow meters.

The instrumentation used for the automated surface water sampling was determined to be more than adequate for current surface water monitoring objectives. D&D monitoring objectives and instrumentation are presented in Section 9.0. No advantages were identified from the evaluation of alternative automated sampling instrumentation.

5.6.3 Field Parameter Monitoring

Surface water grab samples are collected at selected locations throughout RFP to (1) address monitoring requirements imposed by the various regulations and permits, (2) provide a comprehensive onsite water quality database to assist with surface water management at RFP, and (3) develop an offsite database to assess the effects of RFP's activities and to assist in regulatory matters (EG&G 1992i).

Field parameter monitoring is performed during field grab sample collection activities. The specific monitoring requirements depend on the individual drainage basin and associated potential constituents of concern. Each field grab sampling location has a required list of monitoring parameters. Appendix F of the *Draft Surface Water Management Plan* (EG&G 1992i) lists each location and related parameters.

SOPs have been developed by EG&G for surface water sampling. The SOPs describe field sampling methods and equipment required to collect samples and measure field parameters. SW.2, Field Measurement of Surface Water Parameters, dictates the standard parameters and the approved method of measurement.

The majority of the field samples collected during field grab surface water sampling are measured with field instruments manufactured by the Hach Company. Field parameters collected include (1) water and air temperature, dissolved oxygen, and total residual chlorine, which are measured by the Hach Model DR/2000; (2) conductivity, which is measured by the Hach Conductivity/TDS meter; and (3) pH, which is measured by the Hach One portable pH meter. Occasionally, the Yellow Springs Instruments (YSI) Model 50 is used to measure dissolved oxygen.

The instrumentation used to collect field grab samples was determined to be more than adequate for current field parameter surface water monitoring objectives. D&D monitoring objectives and instrumentation are presented in Section 9.0 The field monitoring equipment manufactured by the Hach Company was determined to be reliable and accurate for field monitoring purposes. The field analysis procedures used by the Hach instruments are EPA-approved methods. No advantages were identified from the evaluation of alternative field sampling instrumentation.

5.7 RECOMMENDATIONS FOR SURFACE WATER MONITORING PROGRAMS

The recommendations for surface water monitoring to be conducted as part of the Industrial Area IM/IRA were made by taking into consideration the specific goals of the project, the availability of historical data regarding surface water quality, and anticipated future monitoring efforts on the part of EG&G. In particular, some of the recommendations rely on assumptions about the upcoming storm water NPDES permit.

Thus, these recommendations should be reviewed after that permit has been finalized and issued by EPA.

5.7.1 Base Flow Conditions

The following recommendations are pertinent to the characterization and monitoring of surface water base flow conditions within, or immediately adjacent to, the Industrial Area:

- Additional surface water sampling and gaging stations should be established in areas where seeps occur or where there is base flow in a drainage. The sampling locations should be based on a detailed (point-by-point) analysis of data and locations that were part of the 1989 and 1990 Surface Water and Sediment Geochemical Characterization reports (EG&G 1992j; EG&G 1992k).

- New surface water sampling and gaging stations should be established at the boundary of a drainage subbasin whenever possible.

- These 28 surface water base flow stations should be operative before beginning D&D activities within a drainage subbasin. Base-line quality conditions within each subbasin should be established before beginning D&D activities within a subbasin. (Some of the characterization may occur as part of the Integrated OU Program, and any data generated in that effort should be used in support of base-line characterization.)

- Permanent and automatic flow measurement devices that transmit the data to a computer should be established at each station at which base flow sampling is conducted.

- The process for construction and approval of these monitoring stations should begin immediately. These stations should have remote operation capabilities.

- Establishment of base-line quality conditions for base flows should be conducted for the entire RFP analyte list.

- It is further recommended that a program be implemented to continue monitoring all surface water sampling locations within the Industrial Area at which VOCs, heavy metals, or radionuclides have been identified in elevated concentrations. The data to make these determinations are presented in the 1989 and 1990 Surface Water and Sediment Geochemical Characterization reports (EG&G 1992j; EG&G 1992k), although there is some question as to the reliability of this information compared with present day measurements. These locations have been affected by Industrial Area operations; thus, these are likely locations at which releases from future activities may be detected.

These recommendations for monitoring of base flow conditions are similar to the recommendations for the monitoring of storm water presented below.

5.7.2 Storm Water

The following recommendations are pertinent to the characterization of storm water within, or immediately adjacent to, the Industrial Area:

- New storm water sampling and gaging stations should be established at the boundary of each drainage subbasin to pinpoint possible spills or contamination that may occur during routine or nonroutine activities.

- The new storm water monitoring stations should be capable of operation before beginning D&D activities or other nonroutine activities within a drainage

subbasin. Base-line storm water quality conditions within each subbasin should be established before beginning D&D activities, or other nonroutine activities within a subbasin. (Some of the characterization may occur as part of the Integrated OU Program, and any data generated in this effort should be used in support of base-line characterization.)

- Permanent and automatic flow measurement equipment that transmit the data to a computer should be established at each station at which storm water sampling is conducted.

- The process for construction and approval of new storm water monitoring stations should begin immediately. These stations should have remote operation capabilities.

- Storm water monitoring should be conducted for each storm event above the minimum storm that does not create substantial runoff from a basin or subbasin. These minimum storms must be established on a drainage basin and subbasin-specific level. Such monitoring should include continuous flow monitoring. The low flow monitoring must be integrated with the base flow program.

- In addition to the above basin and subbasin recommendations for storm water monitoring, it is also recommended that the four to six culverts leaving the south side of the Industrial Area have automatic flow monitoring equipment installed. These culverts represent physical control structures for storm water where emergency actions could be taken in response to a release to the environment.

- Base-line quality conditions for storm water flow should be established for the entire RFP analyte list.

- An overall mass balance of pollutant loading on a drainage basin and subbasin basis should be developed for storm water transport of contaminants.

- The return frequency storm of concern for contaminant transport from each drainage basin and subbasin should be determined.

The implementation of these recommendations will allow for the characterization of storm water quality within the subbasins of the Industrial Area as well as where the storm water leaves the Industrial Area. The subbasin-specific data should be particularly useful in identifying any releases of contaminants to the environment from D&D activities or other nonroutine activities.

APPENDIX 5.1

SUMMARY OF CURRENT SURFACE WATER MONITORING ACTIVITIES

(intentionally blank)

Table A. Summary of NPDES/FFCA Compliance Sampling		
LOCATION	**ANALYTES**	**FREQUENCY**
Pond A-3	Nitrate	daily during discharge
	Flow	daily during discharge
	pH	daily during discharge
Pond B-3	5-Day Biological Oxygen Demand (BOD5)	two times per week
	Total Suspended Solids (TSS)	two times per week
	Nitrate	two times per week
	Total Residual Chlorine (TRC)	daily
	Flow	daily
Pond A-4	Whole Effluent Toxicity (WET)	quarterly during discharge
	Nonvolatile Suspended Solids (NVSS)	daily during discharge
	Total Chromium	monthly during discharge
	Flow	daily during discharge
STP	pH	daily during discharge
	Total Residual Chlorine (TRC)	daily during discharge
	Total Suspended Solids (TSS)	three times per week
	Fecal Coliform	three times per week
	Total Phosphorous	three times per week
	Carbonaceous 5-Day BOD	three times per week
	Flow	daily
	Visible Oil and Grease	daily
	Target Analyte List Metals	two times per month
	Volatile Organic Analytes (CLP)	two times per month
	Total Chromium	weekly
	Whole Effluent Toxicity (WET)	quarterly
Pond B-5	Total Residual Chlorine (TRC)	daily during discharge when Pond B-3 is bypassed
	Nitrate	same as TRC
	Whole Effluent Toxicity	quarterly during discharge
	Nonvolatile Suspended Solids (NVSS)	daily during discharge
	Total Chromium	monthly during discharge
	Flow	daily during discharge
Pond C-2	Whole Effluent Toxicity (WET)	quarterly during discharge
	Nonvolatile Suspended Solids (NVSS)	daily during discharge
	Total Chromium	monthly during discharge
	Flow	daily during discharge

Adapted from EG&G (19931). *RFP Surface Water and Sediment Monitoring Program Summary*. January 1993.

Table B. Summary of Agreement in Principle (AIP) Compliance Sampling		
LOCATION	**ANALYTES**	**FREQUENCY**
Pond A-3		
	Tritium	daily during discharge
	Gross alpha/beta	daily during discharge
	Field Parameters	daily during discharge
Pond A-4	Tritium	daily during discharge
	Gross alpha/beta	daily during discharge
	Nitrate	daily during discharge
	Total Suspended Solids/Total Dissolved Solids	daily during discharge
	Field Parameters	daily during discharge
Pond B-5	Plutonium, Uranium, Americium	weekly composite
	Tritium	daily during discharge
	Gross alpha/beta	daily during discharge
	Nitrate	daily during discharge
	Total Suspended Solids/Total Dissolved Solids	daily during discharge
	Field Parameters	daily during discharge
Pond C-2	Tritium	daily during discharge
	Gross alpha/beta	daily during discharge
	Nitrate	daily during discharge
	Total Suspended Solids/Total Dissolved Solids	daily during discharge
	Field Parameters	daily during discharge
Ponds A-4 B-5 and C-2	TSS, TDS, Anions, Nitrate, Alkalinity	predischarge splits with
	Gross alpha/beta	Colorado Department of
	Total Radionuclides (Pu, U, Am, etc.)	Health (CDH), and weekly
	Semivolatile Organic Analytes (Method 625)	splits with CDH during
	Volatile Organic Analytes (Method 502.2)	discharge
	Pesticides (Method 608)	
	Herbicides (Method 615)	
	Triazine Herbicides	
	Total and Dissolved Metals (TAL-CLP)	
Building 124 Raw Water	Plutonium, Uranium, Americium	monthly composite
	TSS, TDS, Anions, Nitrate, Alkalinity	weekly

Adapted from EG&G (1993l). *RFP Surface Water and Sediment Monitoring Program Summary*. January 1993.

Table C. Summary of Operational Monitoring for DOE Orders		
LOCATION	**ANALYTES**	**FREQUENCY**
STP Effluent	Gross alpha/beta	daily
	Nitrate	daily
	Chemical Oxygen Demand	daily
	Total Organic Carbon	daily
	Tritium	daily
	Ammonia	three times per week
	Hardness	one time per week
	Plutonium, Americium, Uranium	daily for a weekly composite
	Field Parameters	daily
STP Influent	Gross alpha/beta	daily
	Ammonia	
	Carbonaceous 5-Day Biological Oxygen Demand	two times per week
	Volatile Organic Analytes (CLP)	two times per month
	Field Parameters	daily
Pond C-2	Plutonium, Uranium, Americium	weekly, four weeks before discharge
Pond C-1	Gross alpha/beta	daily
	Flow	daily
	Tritium	weekly
	Plutonium, Uranium, Americium	weekly composites
	Field Parameters	daily
750/904 Runoff Pad	Gross alpha/beta	during precipitation events/two times a year (two/year)
	Nitrate	during precipitation events/two/year
	Cyanide	during precipitation events/two/year
	Target Analyte List Metals Plus Mercury	during precipitation events/two/year
	Volatile Organic Analytes (CLP)	during precipitation events/two/year
	Ammonia	during precipitation events/two/year
	Field Parameters	during precipitation events/two/year
	Total Dissolved Solids	
	Tritium	

Adapted from EG&G (1993l). *RFP Surface Water and Sediment Monitoring Program Summary*. January 1993.

Table D. Sample Volume, Container, and Preservation Requirements for Analytes in the Event-Related Surface-Water Monitoring Program

Class of Analytes	Volume of Individual Samples from Auto-sampler	Volume Required for Analytical Methods	Preservative	Container	Analytical Methods
Total Target Analyte List (TAL) Metals	1 Liter	100 mL	Nitric Acid to pH < 2	Polyethylene	CLP-Metals SW846-GFAA
Total Non-TAL Metals	1 Liter	100 mL	Nitric Acid to pH < 2	Polyethylene	CLP & SW846 ICPAES & GFAA
Total Radionuclides -Pu, U, Am -Gross Alpha -Gross Beta -Tritium (only at GS11, GS12, and GS13)	4 Liters	4 Liters	Nitric Acid to pH < 2	Polyethylene	GRRASP
Water-Quality Parameters -Anions -Alkalinity -Conductivity -TSS, TDS Nitrate/Nitrite-N -Total P	1 Liter for all constituents plus 250 mL for Total P	1 Liter plus 250 mL	Cool to 4 degrees C	Polyethylene	300.0 310.1 120.1 160.1, 160.2 353.1 365
THE FOLLOWING ORGANIC SAMPLES WILL BE COLLECTED WHEN REQUESTED BY DOE/EG&G					
VOCs (Manually Collected)	120 mL	3x40 mL	Cool to 4 degrees C HCl to pH < 2	Glass VOA Vial	Glass VOA Vial
TCL SVOCs (Manually Collected)	2 Liters	2x1 L	Cool to 4 degrees C	Amber Glass	624
Pesticides/PCBs (Manually Collected)	350 mL	350 mL	Cool to 4 degrees C	Amber Glass	505

Notes:

This Initial Parameter list will be revised after consultation with DOE. The analyte list and analytical methods will be refined to meet the needs of planned interpretive studies.

Frequency of samples: seasonally; approximately four times per year

APPENDIX 5.2

SURFACE WATER MONITORING LOCATIONS MONITORED IN THE 1989 AND 1990 SURFACE WATER AND SEDIMENT GEOCHEMICAL CHARACTERIZATION REPORTS

(intentionally blank)

1989 SURFACE WATER AND SEDIMENT MONITORING STATIONS
STATION ID

Water	Sediment	Water	Sediment
SW001	SED001	SW066	
SW002		SW067	
SW003	SED003	SW068	
SW004*	SED022*	SW069	
SW005*	SED020*	SW070	
SW006*	SED023*	SW077	
SW007*	SED004*	SW080*	SED018*
SW010		SW081	
SW016		SW084	
SW025		SW085	
SW026	SED024	SW086	
SW027	SED025	SW087	
SW028	SED026	SW088	
SW029	SED027	SW089	
SW030	SED028	SW090	
SW031	SED032	SW092	
SW032		SW093	
SW033		SW094	
SW034		SW095	
SW035		SW096	
SW036		SW097	
SW039		SW098	
SW041*	SED017*	SW099	
SW044		SW100	
SW045		SW101	
SW046		SW102	
SW050		SW103	
SW051		SW104*	SED019*
SW053		SW105	
SW054	SED029	SW106	
SW055		SW107*	SED016*
SW056		SW108*	SED021*
SW058		SW113	
SW059		SW114	
SW060			SED031
SW061	SED011		SED032
SW062	SED030		SED033
SW064			SED034
SW065			SED034
			SED036

* Background Station

1989 Surface Water and Sediment Monitoring Stations by Operable Unit or Area

881 Hillside Area (881)	903 Pad Area (903)	Solar Ponds Area (SP)	
		SW084	SW092
		SW085	SW093
SW045	SW050	SW086	SW094
SW046	SW053	SW087	SW095
	SW055	SW088	SW105
	SW058	SW089	SW106
	SW065	SW090	
	SW077		

Landfill Area (LF)	Upper South Walnut Creek (USWC)	Upper South Interceptor Ditch (USID)
SW097	SW022	SW035
SW098	SW023	SW036
SW099	SW056	
SW100	SW060	
	SW061 SED011	
	SW101	

Lower South Interceptor Ditch (LSID)		Woman Creek (WC)	
SW027	SED025	SW028	SED026
SW030	SED028	SW029	SED027
SW031		SW032	
SW044		SW033	
SW054	SED029	SW034	
SW066		SW062	SED030
SW067			
SW068			
SW069			
SW070			

Source: 1989 Surface Water and Sediment Geochemical Characterization Report (EG&G 1992j). This list does not include isolated sampling stations, which are generally located in the buffer zone or background areas.

Grouping of Surface Water Sampling Locations for Areas of Rocky Flats Plant

AREA of the RFP	SURFACE WATER STATION NUMBER							
Background	SW004	SW005	SW006	SW007	SW080	SW083	SW104	SW107
	SW108	SW127	SW130	SW131	SW042			
South Walnut Creek	SW121	SW122	SW123	SW056	SW101	SW059	SW060	SW061
	SW023	SW025	SW103					
Landfill	SW096	SW097	SW098	SW099	SW100	SW014		
North Walnut Creek	SW116	SW117	SW118	SW093	SW017	SW092	SW016	SW015
	SW128							
Solar Pond	SW085	SW087	SW088	SW089	SW090	SW105	SW106	SW091
	SW094	SW095						
South Interceptor Ditch	SW038	SW129	SW036	SW035	SW044	SW031	SW066	SW067
	SW068	SW069	SW070	SW030	SW054	SW027		
OU1 and OU2	SW051	SW052	SW053	SW057	SW055	SW058	SW077	SW071
	SW072	SW125	SW045	SW046	SW126	SW065	SW064	SW050
Woman Creek	SW032	SW033	SW034	SW029	SW028	SW026	SW001	SW002
	SW062	SW041	SW039					
Northwest Protected Area	SW043	SW018	SW124	SW084	SW086	SW102	SW120	SW119

Source: EG&G. 1992j. *Surface Water and Sediment Characterization Report.*

(intentionally blank)

NOTICE:

INCOMPLETE DOCUMENT

This document was distributed in an incomplete state, and the microform copy is representative of the paper copy. Section 6.0 was not listed in the Table of Contents. If replacement pages are distributed, they will be microfilmed and included in the Administrative Record file.

The Adminstrative Record Staff

6.0 AIR MONITORING

Air quality monitoring within the plant boundaries has been ongoing since the 1950s. The RFP monitoring programs emphasize compliance with regulatory requirements and protection of the environment and health and safety of the public. Extensive measurements of radioactive and particulate concentrations are performed in and near research and production areas. The RFP monitoring program includes real-time screening, biweekly filter collection and screening, and a monthly filter composite analysis of radiological particle concentrations. In addition, air effluent emissions from plant operations are continually measured and characterized for the Industrial Area. Although processes within the buildings have ceased, there are still materials and contaminants of interest within and surrounding the Industrial Area facilities. Also, ambient air in and around RFP is continuously monitored for particulates, including radioactive isotopes. All existing and recently proposed air quality and meteorology monitoring and effluent emissions characterization programs, emphasizing Industrial Area activities and contaminants, will be summarized and evaluated in this section.

6.1 APPROACH

The RFP air quality and meteorological monitoring program was evaluated by reviewing existing plans, reports, and documents that (1) summarize ongoing and historical monitoring, (2) describe dispersion and dose modeling, (3) summarize effluent emissions data, (4) evaluate existing monitoring and reporting programs, and (5) make recommendations for revising these programs. The description of existing air monitoring programs provided in this document was summarized from previously published RFP documents. The air monitoring evaluation considered the applicability of existing monitoring programs to existing conditions. Ambient air quality and effluent emissions monitoring are discussed in Section 6.2. Meteorological monitoring is discussed in Section 6.2.8. Air dispersion modeling results are included in Section 6.3; the pathway analysis is found in Section 6.4. The data gaps and recommendations identified during

this evaluation are included in Sections 6.5 and 6.7. An evaluation of air monitoring alternatives is summarized in Section 6.6.

6.2 EXISTING PROGRAMS

At RFP, emphasis is placed on air monitoring programs for continuous stack effluent emission, gaseous effluent emissions, and ambient air monitoring of radioactive and nonradioactive particulates. The programs were designed to collect data on the entire facility. Potential radioactive air pollutant emissions include plutonium, americium, uranium, and tritium. Nonradioactive air pollutants potentially emitted and monitored at the plant are beryllium, oxides of nitrogen (NOx), TSP, and PM-10. Primary chemicals that could be emitted are carbon tetrachloride, Freon 113, hydrogen fluoride, nitric acid, phosphoric acid, sulfuric acid, and 1,1,1-trichloroethane. The primary types of emission sources are stacks, vents, tanks, ponds, landfills, and other diffuse sources. Because production operations at RFP have ceased, some associated emissions have been reduced or eliminated entirely.

Although many operations have been reduced or ceased, potential air emissions are still being controlled. All production and research facilities at RFP are equipped with ventilation/filtration exhaust systems for effluent emissions control. Both radioactive and nonradioactive particles are contained by glove box and filter plenum systems. Particles are removed from the air effluent stream by high efficiency particulate air (HEPA) filters. Multiple banks of HEPA filters are called filter plenums. Other controls at RFP include cyclones, baghouses, and electrostatic precipitators. Acids and other chemical emissions are controlled by scrubbers and charcoal filters; efficient low oxygen burners for gas-fired steam generation are used to reduce NOx emissions.

The RFP air quality programs are administered by the Air Quality Division (AQD) within the Environmental Protection Management (EPM) Department, and the

Emergency Preparedness Offsite Systems (EPOS) branch of the Health and Safety Department. Additional ambient air quality monitoring is performed by CDH.

Several documents have been prepared that summarize existing monitoring programs at RFP and make recommendations for additional sampling locations and procedures. The *Final Environmental Monitoring Plan* (EG&G 1992b) provides a history of air sampling at the plant, a detailed description of the sampling and monitoring programs, quality assurance (QA) procedures for the air monitoring program, and plans and recommendations for program improvements. Other resources that were critical to this evaluation were the *Assessment and Integration of Radioactive Ambient Air Monitoring at Rocky Flats Plant*, September 1993 (EG&G 1993u); *Rocky Flats Plant Air Quality Management Plan* (AQMP) (EG&G 1992m), and *Draft Rocky Flats Plant Radionuclide Air Effluent Emissions Monitoring Program Plan* (EG&G 1993v). The first two documents provide detailed recommendations for monitoring enhancements needed to characterize existing conditions in anticipation of RFP remedial activities and to comply with regulatory requirements. The third plan provides a description of RFP radionuclide air effluent emissions monitoring in compliance with National Emissions Standards for Hazardous Air Pollutants (NESHAP) requirements and the associated QA program. Documents that contain information useful to this evaluation, including those mentioned above, are listed below. Complete references are provided in Section 12.0.

- *Plan for Prevention for Contaminant Dispersion* (DOE 1991a);

- *Assessment and Integration of Radioactive Ambient Air Monitoring at Rocky Flats Plant* (EG&G 1993u);

- *Rocky Flats Plant Site Environmental Report, January Through December 1992* (EG&G 1993c);

- *Draft Rocky Flats Plant Radionuclide Air Effluent Emissions Monitoring Program Plan, RCN-040-93* (EG&G 1993v);

- *Rocky Flats Plant Air Quality Management Plan* (EG&G 1992m); and

- *Final Environmental Monitoring Plan* (EG&G 1992b).

The RFP air monitoring system consists of four subprograms: radiological effluent emissions, nonradiological effluent emissions, radiological ambient monitoring, and nonradiological ambient monitoring. RFP meteorological monitoring, weather forecasting, and air dispersion modeling also complement the air monitoring program. Operating procedures, calibration, maintenance, and analytical procedures for air monitoring systems at RFP are documented in RFP Air Quality Sampling Standard Operating Procedures.

6.2.1 Radiological Emissions Monitoring

The RFP continuously monitors and samples radionuclide air effluent emissions as required by DOE Order 5400.1 and EPA 40 CFR 61, Subpart H. Subpart H establishes the limit for the effective dose equivalent (EDE) of 10 millirem per year (mrem/yr) for any member of the public. Both requirements mandate the continuous monitoring of radionuclide air emissions at all release points with the uncontrolled potential of discharging radionuclides into the air in quantities that could result in an EDE greater than 0.1 mrem/yr. Effluent discharged from RFP buildings is filtered using HEPA filter plenums, but these requirements consider potential emissions without control systems. An emission point that does not have this potential requires only periodic confirmation of low emissions through monitoring data or emission calculation. Because 54 of the ducts and vents have potential doses that are less than 0.1 mrem/year, only periodic confirmation of low effluent emissions is required (EG&G 1993v).

Subpart H specifies radionuclide air effluent monitoring protocol for emission measurement. Effluent flow rates must be measured according to methods in Appendix A to 40 CFR 61. Any change in procedures or methods, including periodic sampling, requires EPA approval. Additionally, measurements at critical receptor locations may be used as an alternative to air dispersion calculations in demonstrating compliance if specific criteria are met (EG&G 1993v).

Although the fabrication and recovery operations have ceased, these facilities are still equipped with functioning ventilation/filtration exhaust systems for particulate control. Building air is filtered with several stages of HEPA filters before being discharged into the outside atmosphere. Generally, two stages are used to filter air from uranium processes, and four stages are used in plutonium processing areas. The HEPA filters are individually bench tested and certified to be no less than 99.97 percent efficient for a nominal 0.3 μm particle size. Filters are tested for leaks after installation into a filter plenum (EG&G 1993n and 1993v).

The radiological particulate monitoring and sampling program uses a three-tier approach composed of SAAMs, TLLA and total long-lived beta (TLLB) particle screening of routine air duct effluent emission sample filters, and radiochemical analysis of isotopes collected from air duct effluent emission samples. This approach balances both sensitivity of detection and timeliness of response for each tier.

There are approximately 130 emissions samplers in 63 air exhaust ducts within 17 buildings. The samplers are located downstream of the HEPA filter plenum. Particulate samples from each exhaust system are composited into monthly samples for specific laboratory analysis of the plutonium, americium, and uranium isotopes following TLLA and TLLB activity screening. These samples are also used for beryllium analyses.

6.2.1.1 Selective Alpha Air Monitors

Thirty-nine SAAMs in the air monitoring program measure alpha activity in air effluent ducts at RFP and provide real-time results. These in-stack monitors are positioned downstream of HEPA filter plenums and are set to detect plutonium-239/240. SAAMs are not designed to provide quantitative measurements of routine plutonium concentrations in air effluent, and no data record is maintained for continuous detected count rates. They are the least sensitive, but most timely, of the three tiers (EG&G 1989). SAAMs initiate visible and audible alarms if the alpha particle activity in the effluent air reaches the plant's internal operating alert levels. The units are connected to a system in the radiation monitoring offices and selected utilities offices that provides remote alarm, readout, and recording of real-time data when an alarm occurs. Both offices are staffed 24 hours a day, seven days a week. SAAM operations and any related QA functions are performed by Radiological Operations and are not the responsibility of the AQD. SAAM operations and QA functions are not intended to meet the monitoring and QA requirements of 40 CFR 61, Subpart H (EG&G 1993v).

The following steps are performed when a SAAM alarm indicating off-normal concentrations is activated: (1) the particulate filter is immediately changed and replaced in the affected unit; (2) the alpha detection instrument and alarm are checked for validity; (3) the appropriate RFP staff are notified; and (4) the SAAM particulate filter is analyzed for specific radionuclide isotopes. These procedures are detailed in ROI-5.07, *Response to Effluent SAAM Alarm*, an RFP standard operation procedure (EG&G 1993v).

6.2.1.2 Particulate Emissions Monitoring

Tiers two and three involve particulate monitoring of filters collected from 130 in-stack samplers. Currently, particulate emission samplers extract samples in either a subisokinetic or superisokinetic manner. Upon EPA approval, all samples will be adjusted to operate at a subisokinetic rate of extraction (i.e., in a manner where the linear

velocity of the gas entering the sample nozzle is less than that of the undisturbed gas stream at the sample point). This method tends to bias toward the excess collection of large particles (greater than 5 microns) and yields a measured concentration of particles greater than the actual concentration in the duct effluent (EG&G 1993v).

The second tier of duct effluent monitoring involves TLLA and TLLB radioactivity screening of routine particulate samples. Sample filters from continuous routine air sampling of effluents are collected twice a week and screened for TLLA and TLLB. Alpha radiation is the principal radiation associated with RFP air effluents. However, naturally occurring, short-lived radionuclides, such as radon decay products, also give off alpha radiation and can contribute to the total alpha activity measured. This contribution can be quantified by taking a count of the samples 24 to 48 hours after collection to allow for the decay of this short-lived radioactivity. The concentration of long-lived alpha emitters is indicative of effluent quality and overall performance of the HEPA filtration system.

TLLA screening is more sensitive than the SAAMs, but requires a minimum of about three days for results to become available. Preparation, collection, and disposition of particulate filters follow RFP air quality sampling standard operation procedure 4-C83-ENV-AP-03, Effluent Air Radioparticulate Sample Collection. If a sample exceeds the RFP internal emissions action limit of 0.02 picocuries per cubic meter, an investigation is initiated to determine the cause of the off-normal concentration and evaluate the need for corrective action (EG&G 1993v).

The third tier of duct effluent monitoring consists of compositing the screened samples on a monthly basis and analyzing the composite sample by radiochemical analysis. The radiochemical analysis is the most sensitive measurement available for determining extremely low levels of radioactive isotopes that might be present in duct effluents under routine operations. Because of the cost and time required for sample analysis and the fact that the amount of radioactive material collected on the biweekly sample filter is

normally below the detection limit of the radiochemical method, a monthly composite sample is used for analysis rather than the individual biweekly samples. The analysis is time consuming and is completed approximately a month-and-a-half following compositing. The radiochemical analysis of routine effluent monitoring samples is completed for the following radioisotopes: plutonium-238, plutonium-239/240, uranium-233/234, uranium-238, and americium-241. The analysis does not differentiate plutonium-239 from plutonium-240, nor does it differentiate uranium-233 from uranium-234. The procedures followed for these analyses are listed in Table 4-2 of the *Draft Rocky Flats Plant Radionuclide Air Effluent Emissions Monitoring Program Plan* (EG&G 1993v). Effluent monitoring data are reported in the *Rocky Flats Plant Monthly Environmental Monitoring Report* (EG&G 1994a). Annual averages are included in the *Rocky Flats Plant Site Environmental Report* (EG&G 1993c).

6.2.1.3 Gas Monitoring

Tritium is the only gaseous radioactive emission material that is routinely monitored at RFP. Although tritium is typically not generated at RFP, a shipment was received from another facility in 1973 that, unknown to RFP personnel, had become contaminated with this material at another facility. Thus, tritium monitoring is necessary to prevent recurrence of such an incident.

Tritium is monitored at six locations through the collection of tritium in water-filled bubbler impingers located in building effluent systems. Samples are drawn continuously and collected three times per week. Laboratory analyses are conducted on each subperiod sample by counting the low energy electrons released from the decay of tritium. The analysis for tritium follows procedure HEA-0014, Preparation of Effluent Samples for Tritium Analysis (EG&G 1992n).

Before 1989, approximately 23 locations were sampled routinely for tritium. Currently, six air effluent ducts with a historical potential for releasing trace quantities are sampled.

The number of sample locations was reduced to six because most of the sample measurements were at the minimum detection limit. Preparation, collection, and disposition of the tritium impinger sample follows procedure 4-C97-ENV-AQ.01, *Rocky Flats Plant Radionuclide Air Effluent Emissions Monitoring Program Plan* (EG&G 1993v).

6.2.2 Nonradiological Emissions Monitoring

Nonradiological emissions monitoring for beryllium is performed at RFP. VOC emissions are estimated as discussed in Section 6.2.6.

6.2.2.1 Beryllium

Beryllium is the only nonradiological particulate emission from stationary sources monitored at RFP. Sixty-three filters from stack samplers are continuously sampled for beryllium emissions. Samples are collected from the same filters used for radiological analyses (Section 6.2.1.2). The emission standard for beryllium is less than 10 grams in a 24-hour period, and the total quantity of beryllium discharged from ventilation exhaust systems in 1992 was 3.399 grams (EG&G 1993c).

The current approach of analyzing monthly composite samples for beryllium is inconsistent with Colorado Air Quality Control Regulation No. 8. The regulation does not require continuous sampling but recommends averaging detected concentrations to calculate emissions for a 24-hour period. RFP beryllium monitoring is performed continuously so averaging for a 24-hour concentration is not necessary. But, because RFP methods are not identical to state methods, the Air Pollution Control Division of CDH requested that RFP conduct one-time beryllium source tests in the five main beryllium effluent ducts in Buildings 444, 447, and 865. Because of the change in mission at RFP, beryllium operations are not expected to continue, and the source tests will not be performed. The potential for beryllium emissions is still present. CDH/EPA

sampling methods may be implemented if applicable to new sources or cleanup operations during D&D activities at RFP.

6.2.2.2 Volatile Emissions

VOC emissions in building effluent are not currently monitored by EG&G at RFP. However, VOC emissions are estimated from chemical inventories and quantities used and are reported in the Air Pollution Emission Notices (APENs). APENs are discussed in Section 6.2.6. The RFP Waste Technical Support Group monitors VOC concentrations at appropriate tanks and piping for RCRA permit compliance. Documentation of this monitoring was not reviewed and is not discussed further in this IM/IRA document.

The Industrial Area includes the following VOC sources:

- building stacks and ventilation systems from VOC process and storage areas;
- outdoor solvent and fuel tanks;
- painting operations;
- maintenance operations;
- treatment, storage, and disposal facilities;
- vehicle emissions; and
- volatilization from surface soils and sediments.

A VOC emission study completed at RFP is described in Section 6.3.

6.2.3 Radiological Ambient Air Monitoring Programs

The Radiological Ambient Air Monitoring Program (RAAMP) includes general RFP and the OU-specific monitoring programs; the samplers are similar but the rationales for sampler location and use differ between the programs.

The CDH Radiation Control Division Surveillance Program monitors ambient air concentrations of long-lived gross alpha and gross beta radioactivity, as well as plutonium-239/240, uranium, and americium-241 in suspended particulate material. These measurements are made on samples collected from 13 samplers numbered D1-11, D13, and E-1, and shown in Figures 6-1 and 6-2. Analytical results are summarized in the CDH Environmental Surveillance Report distributed at the Monthly Information Exchange Meetings. Further information regarding these CDH air monitoring programs was not available at the time of this writing.

6.2.3.1 Radioactive Ambient Air Monitoring Program

The RAAMP objectives are to track the dispersion of airborne radioactive materials from RFP into the surrounding environment and communities, and establish base-line concentrations. Radioactive air monitoring is required by DOE Order 5400.1. Data collected are used to determine the public inhalation dose and are compared to the DOE standard for exposure for all pathways from routine plant operations. There are 47 locations both at RFP and nearby communities that are sampled continuously. The Industrial Area is monitored with 22 samplers, 14 samplers exist along the perimeter of the facility, and there are 11 community samplers. Nineteen of the Industrial Area samplers are within or at the fence line of the Industrial Area. The remaining Industrial Area samplers are less than 1 mile from the Industrial Area fence. Perimeter samplers are between 2 and 4 miles from the plant's center.

RFP and CDH perimeter and Industrial Area samplers are shown in Figures 6-1 and 6-2. These figures show existing RAAMP sampler locations. RAAMP samplers are designated with an S, N, or C preceding a number. The CDH sampler locations designated with an X, D, or E followed by a number, are each instrumented with radionuclide monitors.

RFP samplers collect air particulates on 20- by 25-centimeter fiberglass filters. Manufacturer's test specifications rate this filter medium to be 99.97 percent efficient for relevant particle sizes under conditions typically encountered in routine ambient air sampling. Filters are collected from the samplers biweekly and are composited by location, and analyzed monthly for isotopic analysis at the RFP laboratory. All filters are analyzed for plutonium-239/240 (EG&G 1993c).

EG&G plans to revise the sampler network and replace existing RAAMP samplers with RFP-designed and commercially constructed high volume samplers. The *Assessment and Integration of Radioactive Ambient Air Monitoring at Rocky Flats Plant* document (EG&G 1993u) details planned revisions to the ambient air monitoring program including sampler design, location, and rationale for recommendations. Some RAAMP sampler locations will change, and the entire RAAMP sampler numbering system will be updated. A figure showing the proposed locations for RAAMP samplers was not included in this IM/IRA document because the samplers will be constructed and installed during the next two years. Locations may be revised, and funding may change the number and/or location of samplers that are ultimately installed. Table 6-1 lists the existing and proposed RAAMP network sampler numbers.

Community Radiation Monitoring Program. The RFP Community Radiation Monitoring Program (ComRad) is a cooperative effort of the DOE, EG&G Rocky Flats, Inc., and the communities surrounding RFP. ComRad involves citizen-operated environmental air surveillance stations (EG&G 1992m). One ComRad station is located in each of the cities of Broomfield, Arvada, Westminster, Northglenn, and Thornton. Each ComRad sampling station is equipped with a RAAMP-type sampler, a gamma detector, a thermoluminescent dosimeter, and meteorological monitors.

Analysis of the community high-volume air filters is performed by the EPA Environmental Monitoring Sciences Laboratory in Las Vegas, Nevada. Analysis previously had been performed at RFP by EG&G Rocky Flats, Inc. All reported

TABLE 6-1
Industrial Area IM/IRA/DD
RAAMP Sampler Numbering System

Before 1994	1994	
S-01	S-101*	East of Bldg. 778 (SW edge of Solar Pond 207A)
S-02	S-102	East of Bldg. 549
S-03	S-103	North of Bldgs. 371/374 on perimeter road
S-04	S-104	North of Solar Pond 207C on perimeter road
S-06	S-106	East of sewage treatment plant (co-located with S-006)
S-07	S-107	South of east gate guard shack (co-located with S-007)
S-09	S-109	0.1 mile south of east guard shack (co-located with S-009)
S-10	S-110	Halfway between Bldg. 881 and east gate guard shack (SW of 904 pad)
S-12	S-112	NE corner of Cedar Ave. and 7th Street (RFP)
S-16	S-116	West of Bldg. 371 (outside of Protected Area)
S-19	S-119	Intersection of Central and 903 asphalt road
S-21	S-121	Intersection of the A ponds access road and perimeter road
S-23	S-123	SW of 904 pad, on the buffer zone road
S-25	S-125	Between Solar Ponds 207A and 207B (moved one pole south)
S-31	S-131	NE corner of Highway 93, 1.3 miles north of S-131
S-32	S-132	East of buffer zone, inside gate P-15, west side of Indiana
S-34	S-134	One pole west of CDH Air Sampling Station on south side of Hwy 128
S-36	S-136	East of buffer zone, inside gate P-15, west side of Indiana
S-37	S-137	Intersection of Indiana and east access road, NW corner

TABLE 6-1

Industrial Area IM/IRA/DD

RAAMP Sampler Numbering System (continued)

Before 1994	1994	
C-04	S-138	West side of Indiana St., 0.8 mile south of east access road (co-located with S-038)
S-40	S-140	Intersection of Indiana and Hwy 72
S-41	S-141	North side of Hwy 72, 1.3 miles west of Indiana
S-42	S-142	North side of Hwy 72, 2.9 miles west of Indiana
S-54	S-154	Boulder, east of Curie Circle, across from Bldg. 25 in NBS complex
S-58	S-158	Wagner station (south of 96th on Alkire)
S-68	S-168	SW corner of the intersection of 100th Ave. and Simms
N-01	S-201**	SE of the Wind Site, across access road
N-02	S-202	South of the meteorological tower west of plant site
S-100	S-205	South of the 400 buildings in the Woman Creek drainage (at temporary OU sampler 102 location)
S-101	S-204	South of Bldg. 131 in the Woman Creek drainage (at temporary OU sampler 101 location)
S-102	S-203	0.25 mile west of T130 trailer complex, north side of road (at temporary OU sampler 102 location)
N-06	S-206	East of Pond C-2 (in buffer zone)
N-07	S-207	West side of Indiana (across from nearest residence)
N-08	S-208	NE of Pond A-4 (in the buffer zone)
N-09	S-209	North side of Hwy 72, 0.4 mile east of Hwy 93

TABLE 6-1

Industrial Area IM/IRA/DD

RAAMP Sampler Numbering System (continued)

Before 1994	1994	
N-10	S-210	100 feet north of 108th and Simms (west side of Simms)
N-11	S-211	CDH sampling platform along east access road (east edge of IHSS 216.3 [OU3])
C-01	S-006***	East of sewage treatment plant (co-located with S-106)
C-02	S-007	South of east gate guard shack (co-located with S-107)
C-03	S-009	0.1 mile south of east guard shack (co-located with S-109)
S-38	S-038	West side of Indiana St., 0.8 mile south of east of access road (co-located with S-138)

NBS = National Bureau of Standards

* 100 = New samplers at existing locations

** 200 = New samplers at new locations

*** 000 = Existing samplers (co-located with new samplers)

measurements are consistent with other regional offsite measurements that have been made in the past (CDH 1993a). ComRad results are published on a monthly basis and are available at Monthly Information Exchange Meetings coordinated by CDH.

6.2.3.2 Operable Unit-Specific Monitoring

This program is designed to comply with ambient environmental air sampling requirements in conjunction with remediation at contaminated sites at the plant. The *PPCD* (DOE 1991a) and EG&G's *Environmental Monitoring Division Operating*

Procedures (EG&G 1992n) describe requirements and procedures for suspended particulate monitoring. Environmental investigations will be conducted at 16 OUs. Monitoring programs will depend on planned activities, potential exposure pathways, and the contaminants of concern, and will be designed to monitor for worker protection and to measure concentrations leaving the work area. Any soil disturbance, such as monitoring well installation or test pit excavation, could result in release of material to the air medium. OU-specific human health evaluations include characterization of contaminants, potential exposures, and the potentially exposed population to determine what risks need to be reduced or eliminated, and what exposures need to be prevented.

The IAG defines regulatory requirements for this program. Four high-volume air samplers were operated at OU1 before and during remediation activities. Work at OU1, including operation of the samplers, ceased in September 1993. Samplers have been installed at OU5 (station numbers S-100, S-101, and S-102 shown in Figures 6-1 and 6-2). Air monitoring has been proposed for OU3, but the system has not been established. Two ultrahigh volume sampler locations with operating flow volumes of 500 to 600 cubic feet per minute are under consideration for this system. One meteorological monitoring station will be installed at OU3 to provide site-specific data for dispersion modeling and risk assessments applicable to OU3 and useful for the entire RFP.

The current monitoring program includes high-volume ambient samplers that are operated continuously. Sampler filters are collected from all OU5 sampling locations biweekly, composited monthly by location, and routinely analyzed for uranium-234, uranium-238, plutonium-239/240, and americium-241.

Radioactive particle concentrations are estimated indirectly by continuous, real-time monitoring for respirable particle concentrations using instruments and dosimeters that are not part of the permanent, integrated ambient air sampling program. This sampling and concentration estimation is performed for worker protection, is not performed

routinely, and has limited sensitivity. Additionally, this monitoring is not performed for or by the RFP AQD.

6.2.4 Nonradiological Ambient Monitoring

Ambient particulates are regulated by EPA and CDH under the CAA and its amendments, as defined by the National Ambient Air Quality Standards (NAAQS) and Colorado Air Quality Control Commission Ambient Air Standards. Both TSP and PM-10 are monitored by RFP at one nonradiological particulate air sampling location. Two PM-10 and two TSP samplers are located at this monitoring station. PM-10 replaced TSP as the EPA-designated reference method (40 CFR 50.6) (EPA 1982) for ambient particulate matter, but TSP sampling has continued because the results have several applications. Sampling for a broad particulate size range serves the following purposes: (1) internal management tool; (2) base-line data record; and (3) cross-comparisons with nonroutine ambient radiological particulate sampling studies.

The commercially available air samplers operate at a volumetric flow rate between 1.1 and 1.7 cubic meters per minute, entraining particle sizes up to 50 microns in diameter on the filter surface of the TSP unit and respirable fractions less than 10 microns for the PM-10 sampler. Samplers are operated on a standard statewide sampling schedule of one day every sixth day. Siting for the samplers follows *EPA Guidelines for Air Quality Monitoring Network Design and Instrument Siting* (EPA 1975).

RFP procedure AP.09, *Ambient TSP and PM-10 Air Particulate Sampling High-Volume Method*, provides details on sampling methods for ambient particulates. This procedure follows guidelines established in the *EPA Quality Assurance Handbook for Air Pollution Measurement Systems* (EPA 1983).

The CDH Air Pollution Control Division Surveillance Program maintains monitors that are instrumented to measure oxides of nitrogen, suspended particulate material (TSP and

PM-10), metals, and VOCs in air at RFP (locations labeled with a D, E, or X in Figures 6-1 and 6-2). Nitrogen oxides are monitored at sampler X-3 only. RFP does not have a program to monitor VOC concentrations in ambient air. CDH maintains three ambient air monitoring stations east and northeast of the Industrial Area that monitor VOC concentrations (Figure 6-1). Samples are analyzed in the CDH laboratory using EPA Method TO-1. Analytical results are summarized in the CDH Environmental Surveillance Report distributed at the Monthly Information Exchange Meetings. To date, only a limited number of VOC species have been detected at these sites. Further information concerning CDH air monitoring was not available for review as of this writing.

6.2.5 Emergency Response

The RFP Emergency Plan (EPLAN) (EG&G 1993w) establishes the planning, preparedness, and response concepts for emergencies at the facility. Response measures provide protection for the health and safety of onsite personnel and the public, limit damage to facilities and equipment, minimize impact to onsite operations and security, and limit adverse impacts on the environment. The EPLAN also outlines the interfaces and coordination with offsite federal, state, local, tribal, and private agencies, governments, and organizations regarding emergency response.

The *Air Quality Management Plan* (EG&G 1992m) summarizes the RFP emergency preparedness response capabilities and activities from an air programs perspective. A site-specific dispersion model, the Terrain-Responsive Atmospheric Code (TRAC), was developed by RFP to predict plume path and impacts in a region of complex terrain and rapidly changing meteorology with sufficient accuracy to support protective action decisions by managers in a crisis environment. The TRAC model is continuously operated by the Emergency Preparedness Offsite Programs group of Safety, Safeguards, and Security. The model supports a variety of missions including emergency response, emergency planning, risk assessment, hazards analysis, and regulatory compliance. The

Emergency Operations Center (EOC) has used a version of the TRAC model to produce more than 15,000 automatic plume projections. The model estimates plume path, concentration, and dose (EG&G 1992m).

RFP also uses the atmospheric release advisory capability (ARAC), which is a real-time emergency response system designed to assess the potential impacts of a radioactive material release to the air. Meteorological data are assessed from the event site, with surrounding regional data obtained from the Air Force Global Weather Center. ARAC can be used to produce contour patterns showing the location and levels of surface contamination and the potential radiation dose to people in the area as a result of exposure to the radioactive release (EG&G 1992m). Dispersion models are discussed further in Section 6.3.

RFP is implementing a CTCS to track all chemicals entering the plant site to support an air quality emissions inventory and impending requirements of the federal CAA Title V and the Emergency Planning and Community Right-to-Know Act, Section 302, SARA Title III. This program, combined with the WEMS (Section 3.0), will provide a real-time chemical material balance and inventory for RFP. Inventory data will be housed in a VAX mainframe computer and will use an ORACLE relational database. The CTCS also provides on-line MSDS capability that can be used to provide timely information to nearby communities and emergency response personnel in the event of an emergency. The CTCS will also be useful for emergency planning and preparedness, APENs submittals, and other environmental reports (EG&G 1992m).

6.2.6 Air Pollution Emission Notices

APENs are required by Colorado Air Regulation No. 3 for all three potential sources of air pollutants (criteria, hazardous, toxic) resulting from construction or alteration of any facility, process or activity from which air pollutants are to be emitted. In addition, air emission permits are required for sources that have the potential for significant impact

on air quality unless specifically exempted by law. A base-line emission survey was performed at RFP in 1990 and 1991 (EG&G 1992m). This survey identified sources that require APENs and air emission permit applications. A list of potential VOC sources in the Industrial Area was provided in Section 6.2.2. Approximately 240 individual APENs reports have been submitted to CDH since 1989. These documents include building and process descriptions, raw material usage and characterization, stack and venting information, and air pollutant types and quantities (EG&G 1992m). Updates to RFP APENs reports were submitted to CDH in December 1993.

6.2.7 Stratospheric Ozone Protection

A complete phase-out of chlorofluorocarbon, halon, and carbon tetrachloride use is required under the 1990 CAA amendments. Section 4.4 of the AQMP describes AQD activities designed to meet these requirements.

6.2.8 Meteorological Monitoring

The purpose of the meteorological monitoring program is to provide information for use in assessing the transport, diffusion, and deposition of emissions actually or potentially released into the atmosphere by plant operations. Meteorological data are also used to support the design of environmental monitoring networks for impact assessments, environmental surveillance activities, remediation activities, and emergency response (EG&G 1992b).

Both EPA and DOE require that representative meteorological data be used for dispersion modeling. Meteorological data have been collected at RFP since 1953, but high quality data needed for air dispersion modeling were not collected before 1987. EPA considers a five-year database standard for adequate long-term assessment of air quality impacts at a given site (CDH 1993b). Data are collected on a 61-meter tower in the west buffer zone (Figure 6-2). Instrumentation is attached to the tower at 10 meters, 25 meters, and

60 meters. The real-time data collected from the towers include horizontal wind speed and direction, vertical wind speed, ambient air temperature, dew point temperature, and solar radiation. Precipitation and atmospheric pressure are measured at ground level. A redundant, instrumented, 10-meter tower is located about 100 meters northeast of the 61-meter tower and provides a separate database. Horizontal and vertical wind speed, temperature, relative humidity, and precipitation are measured at the 10-meter tower.

Meteorological data are taken twice a second by data loggers and compiled into 15-minute intervals, 24 hours a day, seven days a week. Data logger units at the base of the 61-meter and 10-meter towers digitize incoming data, provide 15-minute averages of all parameters, and store values in internal solid-state memory. The units also calculate parameter statistics such as average, standard deviation, maximum, and minimum values for each variable. The data loggers at both towers are connected via radio to the RFP Emergency Assessment Facility (EAF). The towers are inspected weekly and will be inspected immediately if suspicious data are recorded. Tower instrumentation is calibrated every six months (EG&G 1992b).

Computer programs are used to store meteorological data in the required format, check the validity of data, update, correct or delete data, store validated data, and provide access to validated data. Each week a portion of data is randomly selected and compared to data from other meteorology stations in the metropolitan area. Computer programs have also been developed to generate descriptive statistics and wind frequency tables. Wind frequency statistics are used to create wind roses. Stability classes are compiled using vertical velocity data (EG&G 1992b).

Two meteorologists work overlapping shifts and prepare forecasts four times a day during normal conditions and more frequently during severe or emergency conditions. Weather forecasting supports emergency response, plant health and safety, and plant operations.

Future meteorological monitoring plans include reinstrumenting the existing 61-meter tower and constructing a new 150-meter tower southeast of RFP at the mouth of the Woman Creek drainage in support of remediation activities and emergency response. Also, one more 10-meter tower will be located within OU3 boundaries to support RI activities. A Doppler Acoustic sounder, capable of measuring winds, turbulence, and stability up to 1 km above the ground, is planned for installation in the buffer zone. These data will support regulatory modeling and emergency response (EG&G 1992m). Purchase of a forecasting workstation, the Real-Time Environmental Applications Product (REAP), is under consideration. This system would provide detailed local and national weather information.

6.2.9 Air Pollution Prevention and Fugitive Emissions Control - Interagency Agreement Programs

The following pollution prevention and fugitive emissions control program is an important part of the RFP remediation projects air quality program. The PPCD was prepared by DOE, Rocky Flats Office (RFO) Environmental Restoration Division (ERD), as required by the IAG under Attachment 2, V (DOE 1991b), and approved by CDH and EPA. In general, the PPCD was developed to ensure that the public is protected from the potential increased health risk associated with inhaling windblown hazardous or dangerous constituents during RFI/RI and IM/IRA activities at RFP, specifically OU-specific environmental investigations. The two primary functions of the PPCD are to (1) provide a management plan to prevent airborne transport of hazardous or dangerous materials and (2) propose an evaluation of the potential for and risk of windblown contaminants from RFP. The PPCD includes specific procedures that (1) establish soil threshold levels, (2) determine the dust emission mitigation required when concentrations are in excess of the thresholds, and (3) establish a monitoring program that will evaluate the effectiveness of dust control measures.

Risk-based soil thresholds for contaminants are derived as a function of activity to be conducted and distance from the site boundary. The application of these soil thresholds is based on public protection criteria; however, implementation of the required control measures and airborne monitoring will ensure that the workers are protected as well.

The PPCD presents criteria for designating intrusive RFI/RI or IM/IRA activities at site locations as Stage 1 or Stage 2. Activities conducted under Stage 1 are performed at site locations that have soil data that indicate contaminant concentrations do not exceed the established soil thresholds. The Stage 1 contaminant dispersion control measures will include the following: establishing wind speed thresholds; water spray soil applications; waste pile covering; and general administrative control measures, such as vehicular speed limitations. The effectiveness of such controls will be measured by occupational health and safety real-time particulate and vapor monitors, soil moisture gauges, and anemometers.

Activities conducted under Stage 2 are performed at locations where RFI/RI intrusive activities such as IM/IRAs will require additional preventive measures and airborne contaminant monitoring. For additional preventative measures, the Stage 2 dispersion control measures will consist of Stage 1 methods plus additional suppression techniques such as extensive wetting, wind screens, spray curtains, or paving. The selection of any particular technique will depend on the activity performed and the effectiveness and/or implementability of the technique under consideration. Airborne contaminant monitoring, in addition to real-time monitoring, provides an integrating record of the dust concentrations during the work activities. The PPCD recommends that site-specific implementation plans and monitoring programs be developed to verify proper execution and effectiveness of the control measures applied.

The PPCD uses simple airborne exposure and risk assessment techniques to evaluate the effectiveness of dust control measures. An emission model is used to predict the rate at which contaminants are released into the air from a source, and a dispersion model

predicts associated concentrations in air at receptor points. A complete modeling set may be used to evaluate the potential for offsite impacts resulting from intrusive activities and as a guide in the selection of appropriate dust control measures.

Although the PPCD is an essential tool for RFP, it is the combination of many controls and programs administrated by RFP organizations that prevent releases from RFP facilities and property.

RFP controls and programs include, but are not limited to, the following:

- HEPA filtration;
- nuclear safety programs;
- radiological engineering programs; and
- the integrated work control program (IWCP).

6.2.10 Quality Assurance

The Environmental Protection QA Program was developed to establish QA requirements applicable to RFP environmental programs. The Environmental QA Program was implemented in May 1991, and updated and streamlined in 1993. The resulting *Environmental Protection Management Plan* (EPMP) (EG&G 1993x) is applicable to all environmental protection program activities. The EPMP describes requirements, methods, and responsibilities for achieving and assuring quality for management, staff, and subcontractors. The EPMP specifies those administrative and technical procedures needed to implement the applicable quality requirements of the RFP QA program (EG&G 1993v). Additionally, the *Air Quality Division Management Plan* (EG&G 1994b) summarizes the QA program developed by the AQD. Further detail concerning EPMP QA requirements for RFP radiological effluent emissions monitoring program may be found in the *Draft Rocky Flats Plant Radionuclide Air Effluent Emissions Monitoring Program Plan* (EG&G 1993v) or the *EPMP* (EG&G 1993x).

The *Rocky Flats Site Environmental Monitoring Plan* (EG&G 1992b) and the AQMP (EG&G 1992m) describe QA procedures for monitoring equipment use, calibration and maintenance, sample collection, and sample analysis for monitoring performed by RFP and EG&G.

RFP ER department OU-specific activities (e.g., PPCD) follow QA programs developed specifically with CERCLA (EPA) programs in mind, and the QAPP is the primary implementing document.

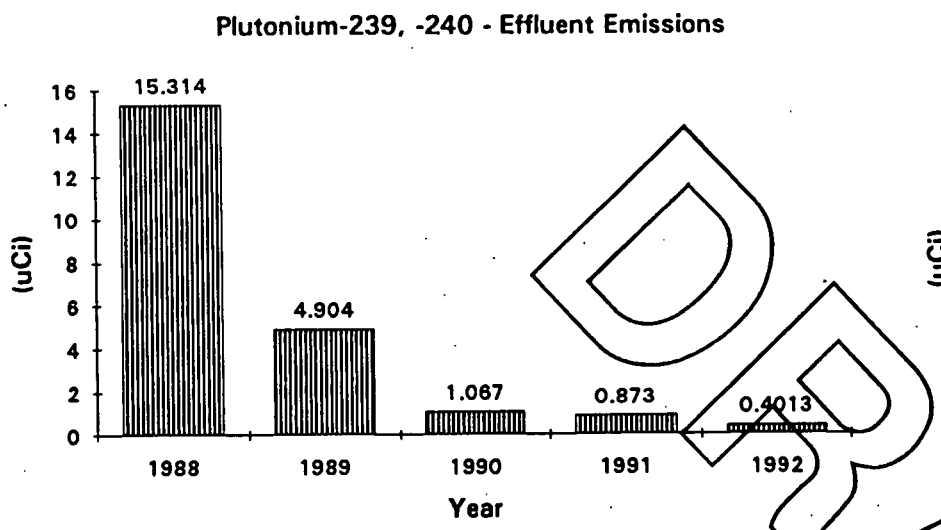
6.3 SUMMARY OF AVAILABLE DATA AND DISPERSION MODELS

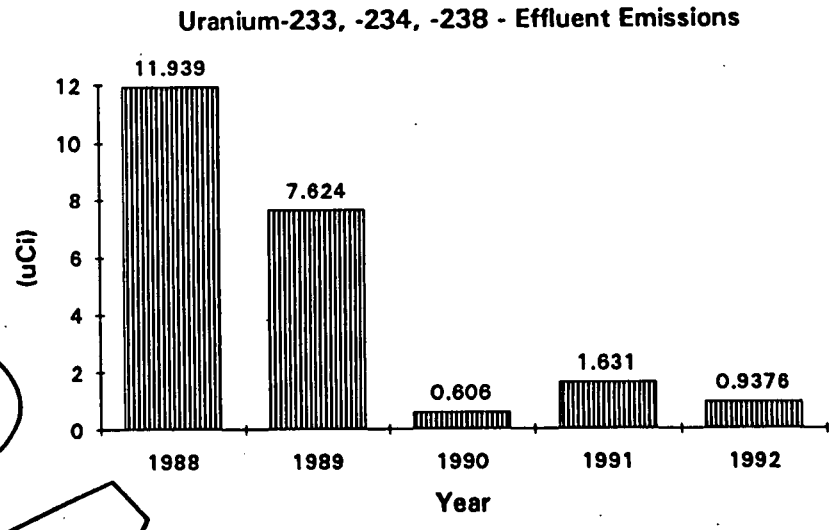
All CDH air quality monitoring data are tabulated on a monthly basis and published by CDH in the Environmental Surveillance Report for distribution to the public. Data from CDH VOC samplers is also summarized in this report. RFP monitoring data are reported in the *Rocky Flats Plant Monthly Environmental Monitoring Report* (EG&G 1994a). These data are also summarized on an annual basis and included in the *Rocky Flats Site Environmental Report* (EG&G 1993c). A summary of 1988 to 1992 RFP monitoring data is provided in Figure 6-3.

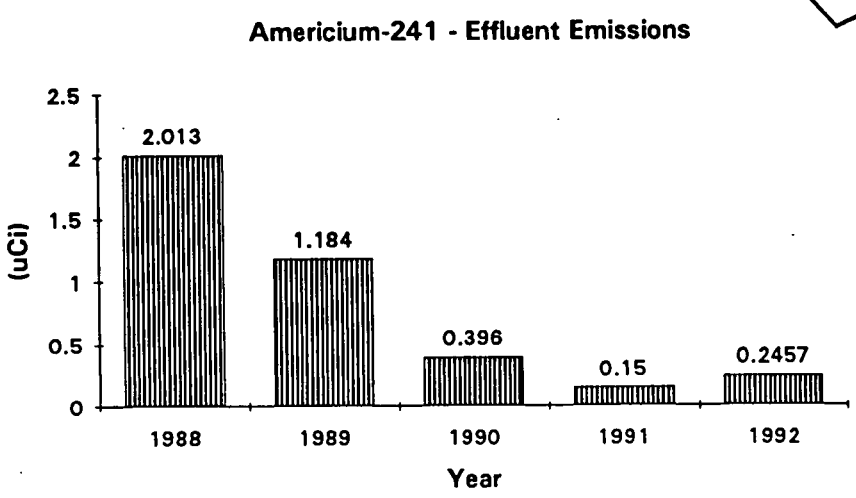
Air quality data are accessible through RFEDS. The system contains data from RAAMP, OU-specific air samplers, and the Radioactive Effluent Air Monitoring Program, and may be manipulated to assist in characterizing RFP airborne radioactivity.

Because no routine nuclear weapons-related processing has occurred since 1989, reported radionuclide point source effluent emissions are believed to be a result of resuspended residual radioactive material in the ventilation systems. Handling of radioactive material at RFP currently involves material consolidation, waste processing, and analytical operations. Most of the total radionuclide air emissions are from diffuse/fugitive area sources associated with past spills or releases (EG&G 1993v).

FIGURE 6-3
Industrial Area IM/IRA/DD
Summary of Rocky Flats Plant Air Monitoring Data
1988-1992







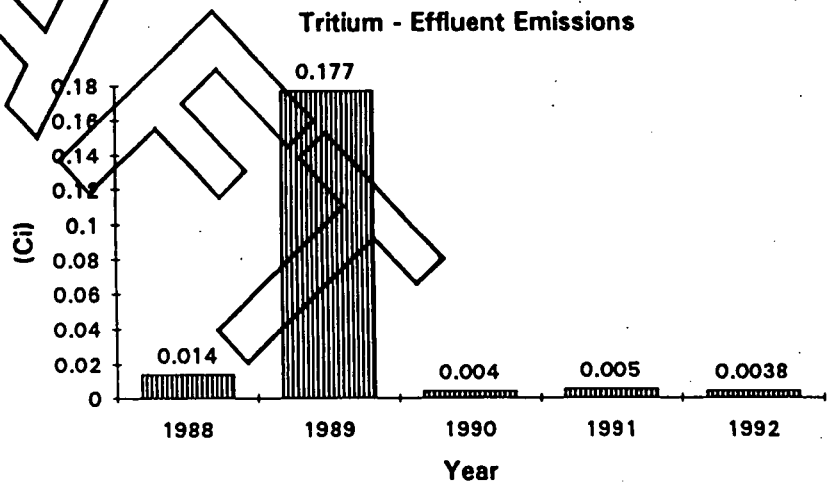
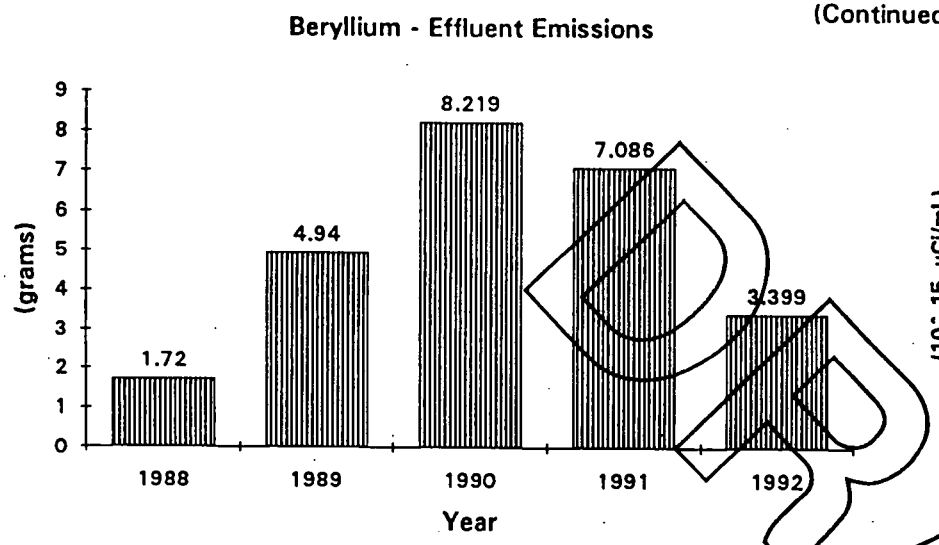
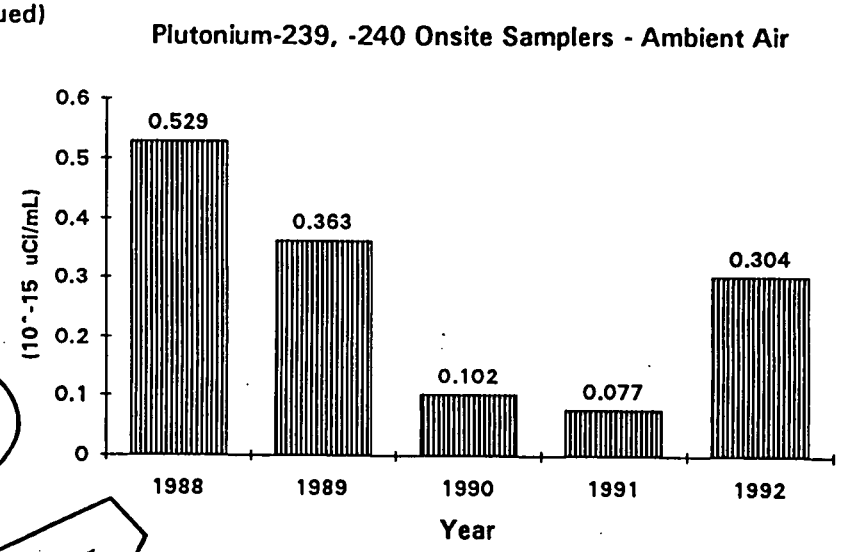
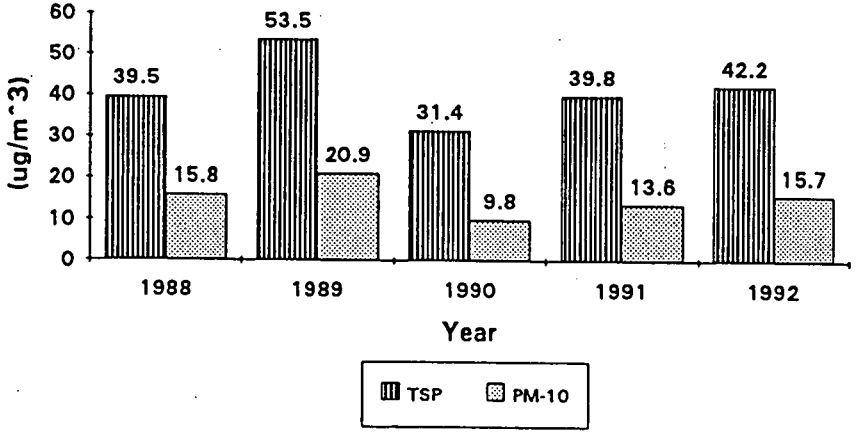
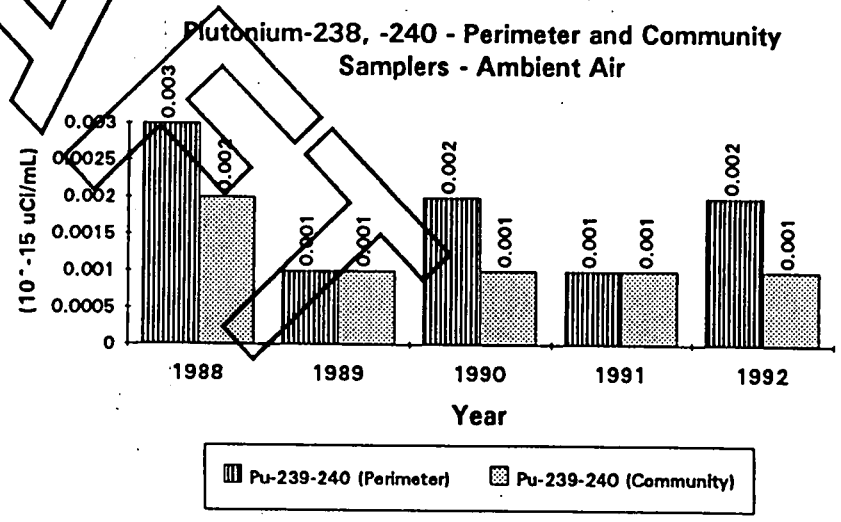


FIGURE 6-3
Industrial Area IM/IRA/DD
Summary of Rocky Flats Plant Air Monitoring Data
1988-1992
(Continued)









uCi = microcuries
Ci = curies

mL = milliliters
uCi/mL = microcuries per milliliter

ug/m^3 = micrograms per cubic meter

Source: EG 1993c
H:\HOME\TWAJT\EXELL\TABLE.XLS

Air dispersion models are used for air quality analysis, emergency response, and to estimate contaminant concentrations. Models that are applied to emergency response issues were discussed in Section 6.2.5. OU-specific air dispersion data have been generated by organizations other than EG&G's EPM, but these data were not reviewed for this evaluation.

The following air dispersion models were used by ChemRisk to predict contaminant concentrations associated with the routine release of contaminants from the filter plenum exhaust and from accidental releases: Industrial Source Complex (ISC) model, Fugitive Dust Model (FDM) and Integrated PUFF (INPUFF) model. Results were reported in *Project Task 6 Exposure Pathway Identification and Transport Modeling* (CDH 1993b). The predicted offsite air concentrations were used in Task 8 *Dose Assessment for Historical Contaminant Releases from Rocky Flats* (CDH 1993c) to reconstruct doses received by the offsite public. The TRAC model could not be used to predict concentrations from past emissions because detailed meteorological data were not available for the historical events of concern.

The CAP88-PC dispersion model (40 CFR 61.93) is used by RFP to calculate radiation dose to determine compliance with EPA CAA NESHAP limits for air emissions of radioactive materials. Dose calculations are summarized in the annual air emission report. The required contents of the report are specified in 40 CFR 61.94 (EG&G 1993v).

A special project using computer dispersion modeling of major sources of VOCs from buildings was initiated to provide design information for establishing an ambient VOC monitoring network. An EPA air dispersion model (ISC2) was chosen to evaluate VOC plume movement on the plant site, buffer zone, and surrounding communities. The analysis used current onsite and regional meteorology, as well as source emission estimates of building VOC releases taken from engineering evaluations. Because the mission of the facility has changed since the dispersion modeling project was initiated

(i.e., major VOC sources are not active), and because the scope of the project was limited, the VOC monitoring program recommendations were not implemented. CDH has conducted its own siting study for RFP fence-line monitoring and installed three monitoring stations (X-1, X-2, and X-3 as shown in Figure 6-1), which are equipped to measure ambient VOC concentrations among other parameters.

6.4 PATHWAYS ANALYSIS

Potential transport pathways associated with sources of air contamination at RFP include (1) routine effluent emissions from process building exhaust stacks and ventilation systems, (2) volatilization from surface water and soils, from recent and historical releases, and from vehicle emissions, (3) fugitive dust from deposition of contaminants from previous emissions and historical releases, and (4) erosion and suspension of particles from previous emissions, historical releases, surface water runoff, and sediments.

Potential movement of contaminants (particles) by wind is possible wherever contaminated soils exist. The likelihood of airborne contamination increases greatly if the site is disturbed by traffic or soil excavation. Dust-borne contaminants mobilized by wind have been documented in some areas of RFP (DOE 1992b).

Some releases involving constituents such as VOCs, while affecting air quality for a time near the release, typically do not spread. However, organic vapors emanating from soils in the vadose zone can serve as an indicator of subsurface releases and potential soil contamination (DOE 1992b).

Chemical classes that may be present in air at RFP include organic solvents, inorganics (specifically beryllium and acids), and radiological particles.

6.5 EVALUATION OF MONITORING PROGRAM AND DATA GAPS

The existing ambient air quality and meteorology monitoring program provides important records of historical trends, establishes base-line conditions, and may be used to characterize major deviations in concentrations that could result from D&D or remedial actions. Because most of the data are not collected on a real-time basis, site-specific samplers will probably be required to monitor changes resulting from individual remedial or D&D activities. However, real-time air sampling with detection capability sensitive enough to detect low radionuclide concentrations is not technically feasible.

There is a need for base-line measurements of ambient VOC concentrations. In the future, CDH is planning to install two additional ambient VOC samplers on the west and south sides of the facility as shown in Figure 6-1 (X-4 and X-5). The exact location and date of installation are unknown. The analytes for CDH's VOC monitoring program includes chemicals not currently used or stored at the facility. Documentation of CDH's monitoring approach for the VOC samplers was not reviewed. Therefore, the rationale for the analyte list and sampler locations is not known. The CDH VOC samplers will provide information on concentrations in air leaving and entering RFP. VOC concentrations are not measured by EG&G within or near the Industrial Area.

For radiological and particulate monitoring, the frequency of sample collection and analysis for the RAAMP program is more than adequate for dose calculations and air dispersion modeling. Recommendations for revisions to these programs are included in Section 6.7.

Attachment A.1.2 of the *PPCD* (DOE 1991a) is a list of potential contaminants selected based on the inhalation exposure pathway and constituents for which accepted inhalation RfC and unit risk factors were available (see Appendix 3.2). This list includes several metals, VOCs, SVOCs, and pesticides that are not currently monitored for in the

Industrial Area as part of the RFP air quality monitoring program. Base-line air concentrations of these constituents have not been established.

6.6 AIR MONITORING TECHNOLOGIES ASSESSMENT

The goal of the air monitoring assessment was to identify new technologies and instrumentation for sampling and measuring effluent air emissions, ambient air quality, and gaseous radioactive air emissions. Real-time monitoring instruments with the capability to detect parameters at environmental levels was of primary interest during the evaluation. For the purposes of this assessment, environmental levels are defined as concentrations from natural background up to the derived concentration guides (DCG) for members of the public in DOE Order 5400.5, Radiation Protection of the Public and the Environment.

The review of new technologies mainly focused on technologies with proven reliability, commercial availability, and cost efficiency. A priority was placed on improvements to existing technologies and upgrades to instruments currently supporting the RFP environmental monitoring program. Table 6-2 summarizes current monitoring instruments and recommendations regarding radiological and nonradiological air monitoring programs. Current monitoring instruments appear to be adequate air monitoring technologies. Recommendations are provided as possible improvements and will require further evaluation.

The following existing environmental monitoring programs were evaluated:

- radiological emissions monitoring;

- nonradiological emissions monitoring;

TABLE 6-2
Industrial Area IM/IRA/DD
Air Monitoring Technologies
Radiological and Nonradiological Emission Monitoring

Current Monitoring Instruments	Recommendations	Rationale
CAM	Adequate, improved CAMs	Improved sensitivity and reliability
Particulate Filter Screening	Adequate	No performance improvements identified
Particulate Filter Counting by Alpha Spectroscopy	Improved alpha spectrometers	Improved sensitivity and reliability
Radiological Analysis	Adequate	Best available technologies
Tritium Gas Monitoring by Scintillation Spectrometry	Adequate, upgrades available in instruments and procedures	Greater sensitivity and reliability Biodegradable liquid scintillation solutions available resulting in waste minimization
Air Emission Sample Filters for Beryllium Analysis	Adequate	Best available technology

Notes: CAM = continuous air monitor

- radiological ambient monitoring;

- nonradiological ambient monitoring; and

- air pollution prevention and fugitive emissions control- IAG programs.

The scope of the air monitoring technologies assessment was limited because of scheduling constraints.

New technologies in the R&D stages were reviewed but not evaluated. R&D technologies for the monitoring of radiological parameters in air is discussed in Section 9.4, Decontamination and Decommissioning Monitoring Technologies Assessment.

6.6.1 Monitoring Technologies Assessment Approach

New technologies were reviewed and evaluated to identify and evaluate new technologies that monitor, and detect potential releases of constituents to ambient air and effluent air emissions at RFP. The assessment approach considered D&D monitoring activities and requirements. The two primary monitoring requirements addressed were real-time monitoring and environmental levels of sensitivity. These technologies were specifically researched for each monitoring parameter.

The review and evaluation of new technologies was approached in the following step-by-step manner:

1. Gain an understanding of the current monitoring programs and identify basic monitoring goals, including the development of technologies assessment criteria.

2. Determine the specific monitoring instruments and technologies currently used by the environmental programs at the RFP.

3. Obtain environmental technologies information from personnel at RFP and other DOE facilities involved with the environmental monitoring programs.

4. Contact the manufacturers of the current instrumentation and determine available upgrades to existing RFP instruments and the benefits achieved from the upgrades.

5. Contact other manufacturers of similar instrumentation to evaluate technologies and compare to current RFP instrumentation performance.

6. Determine R&D technologies available and information contacts.

7. Evaluate information obtained from assessment and develop recommendation.

This assessment identified literature about current and possible future systems, databases, technology information transfer programs, and the strengths and limitations of current and new technologies.

New technologies in the R&D stages were also reviewed. R&D technologies for real-time monitoring at environmental levels of nonradiological parameters in air do exist. However, these technologies will require more evaluation to determine their applicability, cost effectiveness, and reliability.

Existing DOE facilities located in Fernald, Ohio, and Weldon Spring, Missouri, that have radiological and nonradiological environmental monitoring requirements similar to RFP programs were contacted to ascertain technologies and instruments used for monitoring at other DOE facilities. Generally, these facilities were using similar technologies and instruments for their monitoring activities.

Several DOE sources of R&D technologies were discovered including (1) Environmental Technologies Group at RFP, contact Tom Rising, (2) LANL, Technologies Group, contact Joyce Shroeder, and (3) EG&G Nevada Field Office, Office of Technology Development, LATO contact Lee Ziegler. Other private sector R&D innovative technologies sources appear to be available including engineering departments of major instrument manufacturers and educational institutions.

The majority of the manufacturers and/or vendors of environmental air monitoring instruments currently used at RFP were contacted to determine the most recent upgrades and improvements to the existing monitoring instrumentation.

Meteorological and ComRad air monitoring programs were not evaluated during this assessment. Radioiodine air monitoring was not reviewed because the program was eliminated. In addition, worker safety air sampling (industrial hygiene) programs are not discussed in this technologies assessment.

6.6.2 Radiological Emissions

As discussed earlier, radiological emissions are currently monitored by a three-tiered program, SAAMs, particulate emissions monitoring of air duct particulate filters, and radiological alpha spectrometric analysis of isotopes collected on air duct particulate filters. Radiological emissions monitoring also includes tritium gas monitoring. The three-tiered monitoring sequence has varying degrees of sensitivity and response times with each monitoring instrument.

6.6.2.1 Selective Alpha Air Monitors

The SAAMs or CAMs are currently used for real-time alpha activity monitoring at occupational exposure levels. No instrumentation is available for real-time monitoring

of alpha activity at environmental levels because of the low sensitivity required and interferences by short-lived alpha activity.

The *Rocky Flats Plant Final Site Environmental Monitoring Plan* (EG&G 1992b) states that RADēCO (also known as Science Applications International Corporation [SAIC] RADēCO) Models 441, 442, or 442 ARF, solid-state radiation detecting instruments are the current CAMs being used for the continuous direct measurement of alpha activity within building air duct systems.

The CAM instruments currently used for continuous detection of alpha-emitting radioactive aerosols at RFP are acceptable for current monitoring objectives. However, other CAM instruments are available and do offer improved performance over current instruments. Instrument improvements are related to the particulate collection efficiency and therefore greater sensitivity. These improved CAM instrument designs may be capable of detecting less than eight derived air concentration (DAC) hours of plutonium-239 in a background of 1 pCi/L. The sensitivity of the new CAMs is above environmental levels. The new CAMs available were designed to meet the sensitivity recommendation of DOE Order 5480-11, Radiation Protection For Occupational Workers, which is eight DAC hours. However, it should be noted that the final rule (10 CFR Part 835) codifying DOE occupational radiation protection directives does not require the eight DAC hour sensitivity because of the inability to achieve this goal in all operations. The sensitivity of this method for environmental monitoring of radioactivity is limited because interferences of the short-lived alpha activity emitted from naturally occurring radionuclides.

The SAIC/RADēCO Model 452 Alpha CAM may be a possible upgrade. It incorporates the improved design providing greater sensitivity, and it is plug-compatible with the SAIC/RADēCO earlier Models 441 and 442 series alpha monitors.

6.6.2.2 Particulate Emissions Monitoring

Particulate emission monitoring consists of two steps: screening of air duct emission particulate sample filters for TLLA and TLLB during filter removal and radiochemical counting for TLLA. Currently, the instrument used for screening is a Ludlum Model 12-1A portable alpha particle survey meter with an air proportional alpha detector (EG&G 1992b). Each used filter is screened for radioactivity before removal from the filter holder. If the radioactivity level is below 2,500 counts per minute (cpm), the filter is placed in a sample tube carrier. If the level is greater than 2,500 cpm, the filter is placed in a glassine envelope. Filters are transported to the laboratory for analysis.

The technology used for preliminary screening of sample filters for TLLA appears to be adequate for current monitoring objectives. No new technologies were identified that provide improved performance. Improvements to current instrumentation were related to upgrades in electronics and not general performance.

The second step of the particulate emission monitoring is a total long-lived alpha air sample filter activity count analysis by the analytical laboratory. Alpha radiation is the principal types of radiation associated with radionuclide emissions from RFP and can be measured by TLLA radiation detection. However, naturally occurring short-lived radionuclides, such as radon decay products, also give off alpha radiation and can contribute to the total alpha activity measured. This contribution of decay products can be quantified by taking two counts of the air filter samples within 24 hours after collection to allow for the additional decay of this short-lived activity and again after 72 hours' decay. TLLA, which results primarily from plutonium, uranium, and americium, is estimated from the results of the counts. This screening method provides a more sensitive analysis of radioactive duct emissions than CAMs but requires a longer period for the results (approximately three days) (EG&G 1992m).

A Nuclear Data ND ND6620 pulse height analyzer with a multiinput counter module and 90 solid-state detectors is used to determine TLLA activity on the emissions filters (EG&G 1992b).

The technology used for total filter activity counting by the laboratory by pulse height analyzer is adequate but could be greatly enhanced by new instrumentation. It was determined that greater performance and sensitivity may be possible with updated and improved pulse height analyzers. Improvements in the signal processing technology (both hardware and software) have improved modern instrument performance over the instrumentation currently used.

6.6.2.3 Specific Radioisotope Analysis

Specific radioisotope analysis is performed on the air duct emission particulate sample filters mentioned previously to identify plutonium-238, plutonium-239/240, uranium-233/234, uranium-238, and americium-241 by using alpha spectrometry (EG&G 1992b). Samples are collected for one month and a composite (of each source location) performed by radiological procedures. Because the amount of radioactive material collected on the biweekly sample filter is normally below detection limits of the radiochemical method, a monthly composite sample is used for analysis. The analysis is performed by the laboratory and is typically completed in four to six weeks following collection and compositing of filters. The analysis requires a complex and time-consuming analytical process. The radiological analysis performed is the most specific and sensitive measurement available for determining the extremely low levels of radioactive isotopes that may be present in the duct emissions under routine operations.

The methods of radiological analysis used by RFP follow regulatory guidelines and are consistent with industry standards. No new methods or technology for radiological analysis were identified.

6.6.2.4 Gas Monitoring

Tritium is the only gaseous radioactive emission material routinely monitored at the RFP. Tritium is monitored through liquid scintillation counting of discrete bubble impinger samples (EG&G 1992b). Currently, scintillation counting persists as the most widely used industry technique for the analysis of tritium in water. However, improvements in the signal processing technology (both hardware and software) have improved the performance of modern scintillation spectrometers. Moreover, new biodegradable liquid scintillation solutions (cocktails) are rapidly replacing the more toxic scintillation solutions. These new solutions have greatly helped reduce the waste problems associated with scintillation counting. Real-time air monitoring technologies for tritium currently do not have the necessary sensitivity to monitor emissions at environmental levels.

6.6.3 Nonradiological Emissions Monitoring

Beryllium is the only nonradiological particulate material monitored in effluent air emissions from a stationary source at RFP (EG&G 1992b). Samples are collected from the same filters used for radiological analysis as described previously. The method of analysis by Graphite Furnace Atomic Absorption of beryllium samples is considered the best available analysis technique.

6.6.4 Radiological Ambient Monitoring

The radioactive ambient monitoring program includes two programs: the RAAMP program and the OU-specific monitoring program. Filters from the RAAMP samplers are analyzed for plutonium-239/240. Sample filters from the OU monitors are analyzed for uranium-234, uranium-238, plutonium-239/240, and americium-241. The instrumentation used to collect the air samples for both programs are similar. Currently, real-time air monitoring instrumentation is not available for monitoring ambient concentrations of the above radionuclides at environmental levels.

6.6.4.1 Radiological Ambient Air Monitoring Program

The instrumentation used for the RAAMP program by RFP currently includes two types of high volume samplers: existing RAAMP samplers and the newly designed Rocky Flats impactor samplers (EG&G 1992b). CDH also monitors for airborne ambient radioactive particles at RFP. The CDH high volume air samplers are made by General Metal Works. One of the CDH samplers is equipped with a cascade impactor system.

Construction of the Rocky Flats impactor samplers is scheduled to start in the first quarter 1994. EG&G has scheduled to have all the existing RAAMP samplers replaced with the improved design by 1995. The new samplers are designed by EG&G and satisfy regulatory and DOE requirements. The design of the new air samplers also takes into account various external oversight recommendations generated by evaluations of the RFP air monitoring program (EG&G 1993u).

The new sampler design provides the ability to separate radioactive particles into two size ranges and retain them for analysis. These new samplers appear to be more than adequate for the monitoring of ambient air conditions using current technologies. Other air monitoring sampling equipment is available; however, basic technologies are similar and no advantages were identified.

Sample filters from both types of RAAMP samplers are collected biweekly and composited monthly by location before being submitted to a laboratory for isotopic analysis. The analytical methods and the frequency of sample collection and compositing used for isotopic analysis of high volume air filter samples appears technically sound and adequate.

6.6.4.2 Operable Unit-Specific Monitoring

The purpose of the current OU monitoring program is to address requirements for environmental ambient air sampling in conjunction with remediation of contaminated sites at RFP. The technologies and instrumentation used for OU monitoring are discussed in this section.

Air samplers that use laboratory analysis for ambient air OU monitoring include temporary high volume air samplers, existing RAAMP samplers, and ultrahigh volume air samplers. Real-time instrumentation supporting OU monitoring include piezobalances, Miniature Real-Time Aerosol Monitor (MINIRAM), laser particle counters, HNu, and organic vapor analyzer (OVA) (DOE 1991a).

The piezobalance, MINIRAM, and laser particle counters are real-time instruments used to monitor fugitive dust emissions. They are capable of detecting TSP at occupational action levels and verifying the effectiveness of dust suppression techniques. The OVA and HNu are real-time instruments for the detection of VOCs.

The temporary air samplers are commercially available units made by Hi-Q Environmental and use internal brushless motors with flow control and flow totaling. These samplers use a mass flow-controlled circuit to maintain a constant flow rate throughout the sampling cycle. Remediation activities also make use of several RAAMP samplers in the vicinity of the respective OU.

Ultrahigh volume air samplers will be used at OU3 for time efficiency to collect a sufficient volume of particulate sample. Sufficient sample volume is paramount in the detection of low levels of ambient radiological activity in air-suspended particulates. Ultrahigh volume samplers are capable of collecting a sufficient air sample volume in a shorter amount of sampling time by using ultrahigh flow rates (i.e., 500-600 cfm). This sampling capability allows for decreased sample collection and hence faster data

reporting. RFP has supported considerable research on suspension and resuspension of radioactive particles; ultrahigh volume samplers were developed through this research.

The results of this assessment determined that the air sampling methods and instruments used for OU monitoring are more than adequate. These instruments are reliable and are proven technologies for ambient radiological air monitoring at environmental levels. No real-time instrumentation is available that has the capability of air monitoring radiation at environmental levels. However, the *PPCD* (DOE 1991a) suggests a mass loading correlation with radionuclide levels in air. The PPCD program is discussed in Section 9.0. Most real-time monitoring equipment is limited to worker safety levels of radiological activity.

The laboratory analytical methods selected for the analysis of ambient air monitoring filters for OU monitoring are similar to those described for the RAAMP filters and were found to be adequate for current monitoring. OU ambient air monitoring filters are collected weekly or biweekly, and composited monthly by location. The parameters analyzed for depend on the specific OU being monitored.

6.6.5 Nonradiological Ambient Monitoring

TSP and PM-10 are currently monitored at one nonradiological particulate air sampling station at RFP. The siting, sampling, and analysis methods used for TSP and PM-10 monitoring follow current EPA recommended guidelines and are considered industry standards. CDH's Air Pollution Control Division also monitors for TSP, PM-10, and beryllium at three sites along the outside boundary of RFP with two additional sites planned.

Ambient monitoring for VOCs, SVOCs, and metals are recommended in Section 6.7 for establishment of an ambient air quality base-line concentration at RFP. Ambient air quality base-line information should be collected before remediation or nonroutine

activities are started. The current nonradiological ambient air monitoring program and recommendations for improvement are summarized in Table 6-3.

6.6.5.1 Total Suspended Particulates

The TSP samplers currently used at RFP and CDH are General Metal Works Model GS 2310, equipped with an electronic seven-day timer, elapsed timer, and electronic mass flow controller for maintaining stable flow rates. Operational flow rates are maintained within reference guidelines (Title 40 CFR, Part 50, Appendix B). Flow readings are taken with an 8-inch rigid manometer. The TSP sampler currently used by RFP incorporates the best available technology for monitoring for TSP. However, these units will be upgraded with a brushless motor design unit by the end of 1994. These Hi-Q Environmental style samplers will reduce maintenance by increasing blower motor operation. Digital flow control and flow totalizer capabilities will also improve overall flow rate data quality. Other TSP air samplers are available based on the similar technology and principles but provide no appreciable advantages.

6.6.5.2 Particulates Less Than 10 Microns in Diameter

The PM-10 sampler currently used at RFP and by CDH is a Weding and Associates Model 10 Micron Inlet, equipped with a size selective inlet and volumetric flow control system, mechanical seven-day timer, and 24-hour elapsed timer. Airflow readings are taken using a 20-inch rigid manometer (or equivalent electronic transfer standard). The unique design of the Weding critical flow device allows for the use of an inexpensive motor/blower. The sampler flow remains more constant than a sampler using an electronic mass flow type controller. The Weding PM-10 sampler is a proven and acceptable design to measure PM-10 particulates. Other samplers are available using the similar basic designs; however, no performance advantages were identified.

TABLE 6-3
Industrial Area IM/IRA/DD
Air Monitoring Technologies
Radiological and Nonradiological Ambient Monitoring

Current Monitoring Instruments	Recommendations	Rationale
High Volume Air Samplers (RAAMP Program)	Upgrade system with improved EG&G samplers and integration of air sampling program by telemetry	Improved sampling techniques and sampling quality
Temporary High Volume Samplers (OU-specific)	Replace with improved EG&G samplers	Improved sampling techniques and sampling quality
Ultrahigh Volume Samplers (OU-specific)	Adequate	Decreased sample collection time
Total Suspended Particulates (TSP)	Adequate, integration of program by telemetry	Industry standard, best available technologies
Particulate Matter less than 10 microns in diameter	Adequate, integration of program by telemetry	Industry standard, best available technologies
Volatile organic compounds (currently not monitored)	Monitoring using Summa canisters plus EPA Method TO-14	APENs and base-line air quality establishment
Semivolatile organic compounds	Summa canisters and analysis by EPA Method TO-14	Establishment of base-line air quality data
Pesticides	Collect using PUF and analysis by EPA Method TO-04	Establishment of base-line air quality data
Metals	High volume air samplers or TSP samplers	Establishment of base-line air quality data

Notes: EPA = U.S. Environmental Protection Agency
RAAMP = Radioactive Ambient Air Monitoring Program

6.6.5.3 Volatile Organic Compounds

Currently, no VOC emissions are monitored by RFP at environmental levels. However, CDH's Air Quality Control Division does monitor for VOCs at three locations outside and along the RFP boundary. Two additional monitoring stations for VOCs are planned pending power access and land permission. CDH's air monitoring program uses Tenex air sampling instruments and EPA analysis Method TO-1 to monitor for VOCs.

Basically, two collection methods (Summa canisters and Tenex tubes) are commercially available for the detection of VOCs in air at low environmental levels. However, these methods are supported by laboratory analysis and are not capable of real-time continuous monitoring. Real-time continuous monitoring of VOCs in air at remote locations is available using portable gas chromatograph instrumentation. However, portable gas chromatograph instruments were assessed and determined to require high maintenance and are unreliable. Other methods of real-time VOC air monitoring do exist but do not measure continuously and have high levels of sensitivity.

Ambient VOC monitoring is recommended (1) before D&D to establish a base-line air quality profile and (2) during D&D activities to monitor air quality. The monitoring techniques and instruments recommended for ambient VOC monitoring at RFP are sample collection by Summa canister and analysis following EPA Method TO-14.

The Summa canister and EPA Method TO-14 monitoring recommendation is supported by the following:

- RFP air monitoring personnel currently have Summa canisters and are familiar with TO-14 analytical methods.

- To improve sample collection quality, a Summa canister collects more than an ample amount of sample for laboratory analysis and reanalysis, therefore, decreasing the need for sample re-collection if a sample is lost as a result of laboratory problems.

- The cost of sample collection by Summa canisters is similar to Tenex, considering a backup Tenex sample is normally collected because of sampling quality associated with Tenex samplers.

6.6.5.4 Metals

Metals analysis may be performed on filters collected for particulate concentrations in air by the high volume air sampler discussed previously. No real-time instruments are available for metals analysis in air at environmental levels.

6.6.6 Air Pollution Prevention and Fugitive Emissions Control - Interagency Agreement Programs

The monitoring equipment used for the Air Pollution Prevention and Fugitive Emissions Control - IAG Programs is primarily related to occupational safety monitoring over short periods (less than 10 hours). The equipment is portable and provides direct and indirect real-time measurements of air quality. The instruments are designed to be used as close as possible to the work area (approximately 5 to 10 meters).

The monitoring equipment recommended for use during the Air Pollution Prevention and Fugitive Emissions Control activities for air contaminant measurement include piezobalance, high volume samplers, laser particle counters, MINIRAM, HNu trace gas analyzer, and photovac microtip handheld air monitor (DOE 1991a). A more detailed discussion of the instruments used for air pollution prevention and fugitive emissions control activities is provided in the *Final PPCD* (DOE 1991a).

These real-time instruments will provide assurances that airborne constituents do not exceed predetermined concentration levels over short periods. Some monitors are capable of measuring constituent concentrations directly, but most are capable of only indirect measurement of concentrations. None of the instruments directly measure radionuclides.

Real-time measurements made during implementation of the Air Pollution Prevention and Fugitive Emissions Control - IAG Programs will be the primary means of evaluating the mitigative measures' effectiveness (DOE 1991a). Real-time direct and indirect measurements should be made within the work zone during D&D activities. Measuring concentrations of contaminants using the available technologies and instruments at the Industrial Area or RFP boundary is not practical. This impracticality is mostly a result of atmospheric dispersion that significantly reduces airborne concentrations from the point of origin. Consequently, air monitoring to evaluate the mitigative measures' effectiveness should be monitored near the D&D activities. This requires establishing an action level concentration that can be measured near the emission source (i.e., D&D activities), which can be correlated to an acceptable concentration at the Industrial Area perimeter or RFP boundary based on ambient high volume air sampling analysis data. Action levels established for air pollutions and fugitive emissions monitoring are provided in the PPCD.

6.7 RECOMMENDATIONS FOR MONITORING PROGRAMS

Recommendations for addressing data gaps identified during evaluation of the RFP air quality monitoring program are described in this section. The recommendations are broken down into the following programs: radioactive and nonradioactive emissions monitoring, radioactive and nonradioactive ambient air monitoring, meteorology, and contaminant dispersion prevention.

6.7.1 Radioactive Emissions Monitoring

Because the mission of RFP will require that some activities be performed within the process facilities, no changes to the current effluent emission monitoring program are recommended. The current program is more than adequate to characterize concentrations in Industrial Area building effluent emissions.

6.7.2 Nonradioactive Emissions Monitoring

Beryllium sample collection frequency should be decreased or halted until D&D begins in process and storage areas, as recommended in the *AQMP* (EG&G 1992m).

6.7.3 Radioactive Ambient Air Monitoring

The DOE proposed plan for new samplers and new sampler locations documented in *Assessment and Integration of Radioactive Ambient Air Monitoring at Rocky Flats Plant* (EG&G 1993u) should be implemented before significant progress is made on RFP remedial activities or mission transition and D&D. The proposed network appears adequate and is an improvement over the existing network. The new locations and samplers will provide data in areas generally downwind of the Industrial Area that were not previously sampled. By proceeding as soon as possible, base-line data on the new equipment and locations may be collected and necessary revisions to the program made before the potential for release increases. It is also recommended that OU-specific RAAMP samplers be installed, tested, and a base-line data set compiled before intrusive activities begin.

6.7.4 Nonradioactive Ambient Air Monitoring

Base-line concentrations of metals, volatile and semivolatile organic compounds, and pesticides identified in the PPCD List II (DOE 1991a) should be determined for the

Industrial Area. Additional samplers are not required to determine metals concentrations in air. Metals analysis may be performed on filters collected for particulate analysis (PM-10) and reporting. Installation of permanent samplers is not required. When possible, samplers should be located at existing RFP or CDH sampler locations for ease of access for sample collection and utility connections. Additionally, existing sampler locations are generally based on air dispersion modeling or best technical judgment and are in the RFP computer mapping system. If new locations must be established, use of the TRAC model, combined with the technical knowledge of RFP air quality personnel, should be sufficient for determining sampler locations.

Monitoring to establish base-line conditions can be performed during a short time, if well planned. Duration of monitoring could range from one week to several months. Some factors that will determine the length of time required to develop a base-line data set include the following:

- Representative conditions - Were conditions during monitoring (weather, site activities) representative of normal site conditions?

- Detection - If COPCs were not detected, locations may need to be revised, sampling frequency decreased, or specific sampling or analyses considered complete.

- Data availability - Turnaround time for results from laboratory analysis may control the duration of data collection to establish the desired data set.

- Sources - Sources of COPCs will continually be removed as transition of facilities progresses. If all known sources of a COPC have been removed, continued monitoring may not be warranted.

The COPC list for air may be refined by reviewing analytical results from the surface water, groundwater, and soil monitoring programs.

The justifications for collecting base-line metals, VOCs, SVOCs, and pesticide concentrations within the perimeter of the Industrial Area include the following:

- The new Colorado CAA requirements for air toxics will regulate and control many of the constituents not previously controlled. These will include many of the previously discussed constituents.

- Risk assessments will be performed to define levels of cleanup. These risk assessments will require air monitoring to determine base-line concentrations of constituents present in the air at RFP and to be used for confirmation of modeled results.

The change in mission at RFP has led to a decrease in VOC use and emissions from plant facilities. CDH sampler results appear to support this decrease and suggest that the analyte list for the site perimeter can be evaluated and reduced. Any changes to the analyte list should be based on past VOC sampler results as well as current and planned VOC use.

Although the data from the three CDH samplers do not indicate the continued release of VOCs, these samplers are not located near Industrial Area sources. Measurement of ambient concentrations of VOCs in the Industrial Area is recommended to characterize the facility with base-line data before remedial or nonroutine activities are conducted. By locating VOC samplers within and around the perimeter of the Industrial Area base-line concentrations could be measured. Recommended locations for these samplers are North, South, East, and West of the Industrial Area fence line. If it is appropriate to install VOC samplers at existing RAAMP locations, the following locations will satisfy the above recommendation: S-16, S-04, S-07, and S-100. These locations are shown in Figure 6-2. It is recommended that air dispersion modeling be performed to assist in locating both base-line and other general use VOC samplers. VOC samplers could later be used to monitor for potential releases resulting from D&D activities.

Additional air dispersion modeling is recommended to determine if there are other areas outside the Industrial Area where monitoring should be performed. Air dispersion models should be based on current or future Industrial Area activities.

6.7.5 Meteorological Monitoring

Existing and proposed meteorological monitoring is more than adequate to meet the needs of RFP. No recommendations are necessary for this program.

6.7.6 Contaminant Dispersion Prevention

When appropriate, the procedures outlined in the PPCD (DOE 1991a) should be followed for remedial and D&D activities performed at RFP. In addition, the PPCD should be revised as necessary during these activities. As mentioned earlier, this plan includes general procedures for prevention of contaminant dispersion. By following or adapting these procedures in future work plans, duplication of effort can be avoided and planning can be streamlined.

(intentionally blank)

7.0 INCIDENTAL AND FOUNDATION DRAIN WATERS

Incidental waters are defined by the EG&G Rocky Flats Surface Water Division as any waters that accumulate in one or more of the following areas: excavation sites, pits, trenches or ditches, secondary containments or berms, process waste valve vaults, electrical vaults, steam pits and other utility pits, and/or telephone manholes. Incidental waters also include fire suppression system discharges, and the natural collection of precipitation and storm water runoff in excavations, pits, trenches, ditches, and depressions (EG&G 1993y). In general, the primary source of incidental water is considered to be storm water, but it can also originate from groundwater in some cases.

For the purposes of this report, the term "incidental waters" will also include water found in foundation drains and building sumps. In addition, the terms "foundation drain" and "footing drain" are used to describe the drains that are under buildings and along foundation footings. While foundation drains and footing drains are technically different based on location under a structure or building, they serve the same purpose and often interconnect. Because of these reasons, for the purpose of this report, both foundation drains and footing drains will be identified as "foundation drains." These foundation waters often flow into the storm drain system or directly into the environment and can potentially transport contamination. Foundation drain waters generally originate as groundwater, although some of the foundation drains could have storm water flow into them. Storm water interaction could originate from the direct piping of roof drains into the foundation drains or, more probably, from storm water seepage through the backfill into the foundation drains.

Incidental waters may potentially become contaminated from contact with hazardous materials in buildings, IHSSs, other historical release areas, or contamination from under the buildings. It may be necessary to collect and treat these waters before they enter the environment. This section of the IM/IRA/DD discusses incidental waters (including

waters from foundation drains and building sumps) and their current management and treatment, and makes recommendations to be considered for future activities.

7.1 APPROACH

To understand the interactions of incidental waters and foundation drains with other aqueous flow paths, DGOs were developed to streamline the literature search. The DGOs state the objectives, limits and boundaries, and the general approach of the work to be done.

The general approach used to understand the incidental water management program was to first research and gather information for all of the listed inputs (locations of foundation drains, vaults, elevations, known or suspected source areas, sources of other incidental water, potential and existing water treatment techniques, etc). This information was screened for relevance and a general plan of action was created. The action plan was further refined as more information was gathered during the course of the project.

Specific tasks and subtasks were set in order to define the areas of concentration. The following were major tasks involved in the IM/IRA: (1) locate the foundation drains, building sumps, valve vaults, and utility pits in the industrial area through literature searches, review of as-built drawings and visual inspections, (2) assess the current surface water program and water management plan, and (3) assess current water treatment capabilities at RFP and propose possible changes or alternatives to these treatment facilities. The purpose of the end product was to provide administrative guidance for the characterization and disposition of incidental waters.

Project objectives did not include any of the following: the buffer zone or offsite receptors, any risk component of water quality standards research, or analysis of sampling/monitoring results to determine compliance with any Applicable or Relevant and Appropriate Requirements (ARARs), benchmarks, or regulations. Assessments that

would require flow information were a limitation since this information was not available. Site walks did not include building entry or manhole cover removal.

7.2 FOUNDATIONS, FOUNDATION DRAINS, BUILDING SUMPS, VALVE VAULTS, AND SIMILAR SOURCES OF INTERCEPTED GROUNDWATER

The incidental waters that originate in building sumps, foundation drains, vaults, and basements are of particular interest. Each building in the industrial area was researched to determine which buildings had foundation drains or sumps. Figure 7-1 shows the locations of each of these drains, sumps, vaults, and pits based on available as built drawings. All as-built drawings were taken as current. No checks were made on these data.

7.2.1 Interaction of Foundation Drain Location with Groundwater

Figure 7-2 shows typical foundation drains. Because the building foundations often intersect the groundwater table and may potentially carry water with unwanted constituents, the drains may be considered a potential contaminant migration pathway. This interaction is discussed in more detail in Section 7.2.3.

7.2.2 Interaction of Foundation Drain Location with Surface Water

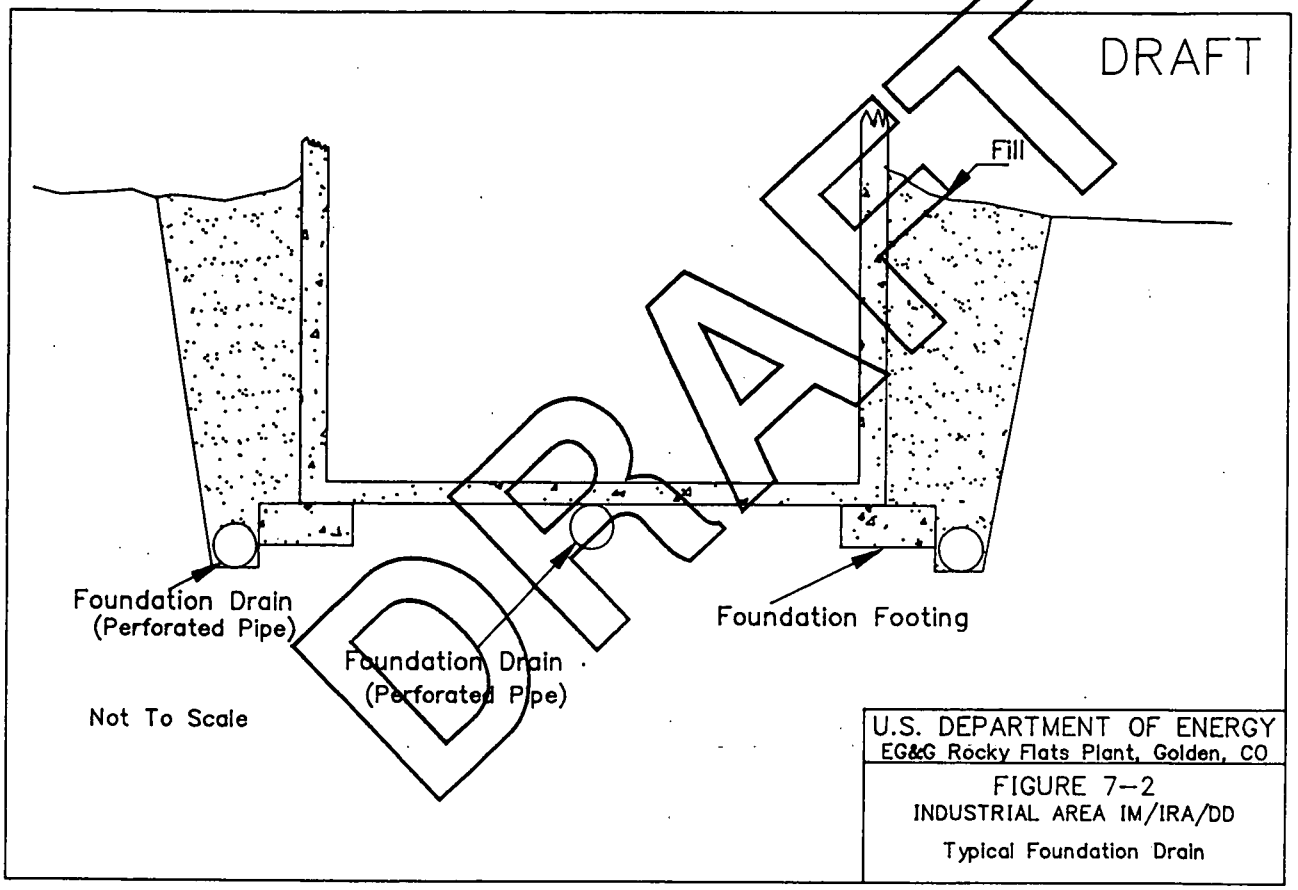
The majority of the foundation drains in the Rocky Flats Industrial Area currently discharge directly into the environment. These outfalls usually occur on hill sides, discharge to a drainage area, and then become part of the surface water. This interaction may be of concern if the foundation drain water is potentially contaminated. All known foundation drain flows are monitored before they reach RFP drainage ponds. The flowpaths and monitoring points for specific foundation drains have been identified in Section 5.0 of this report.

7.2.3 Principles of Foundation Drain Interactions

Foundations, foundation drains, sumps, valve vaults, and other structures may intersect the groundwater table. The Rocky Flats area receives a yearly average of 15.2 inches of precipitation; March, April, and May are the wettest months. Depending on the location within the plant site, the concentrated precipitation during these months occasionally causes the groundwater table to rise 5 to 25 feet to within less than 5 feet of the land surface (based on quarterly sampling results in the Industrial Area). Because the foundations of the buildings in the Industrial Area may extend into the saturated zone, the potential for interaction with the groundwater exists. Figure 7-3 schematically illustrates this interaction. This interaction is usually somewhat localized in the bedrock, although some effects may be observed in the upper hydrostratigraphic unit. When the water table rises above the level of a dry foundation, the pressure (head) on the outside of the building becomes greater than the pressure on the inside, thus creating a pressure gradient toward the inside of the building.

When the water table is high, creating the possibility for flow into the building, the potential exists for water to come in contact with building contaminants. Water will not be able to flow out of the building until the water table lowers, keeping any potential contaminants within the building foundation. When the pressure gradient reverses as the water table lowers, this water could be returned to the environment. This is of concern, since in this situation the water may have come in contact with contaminants inside the building.

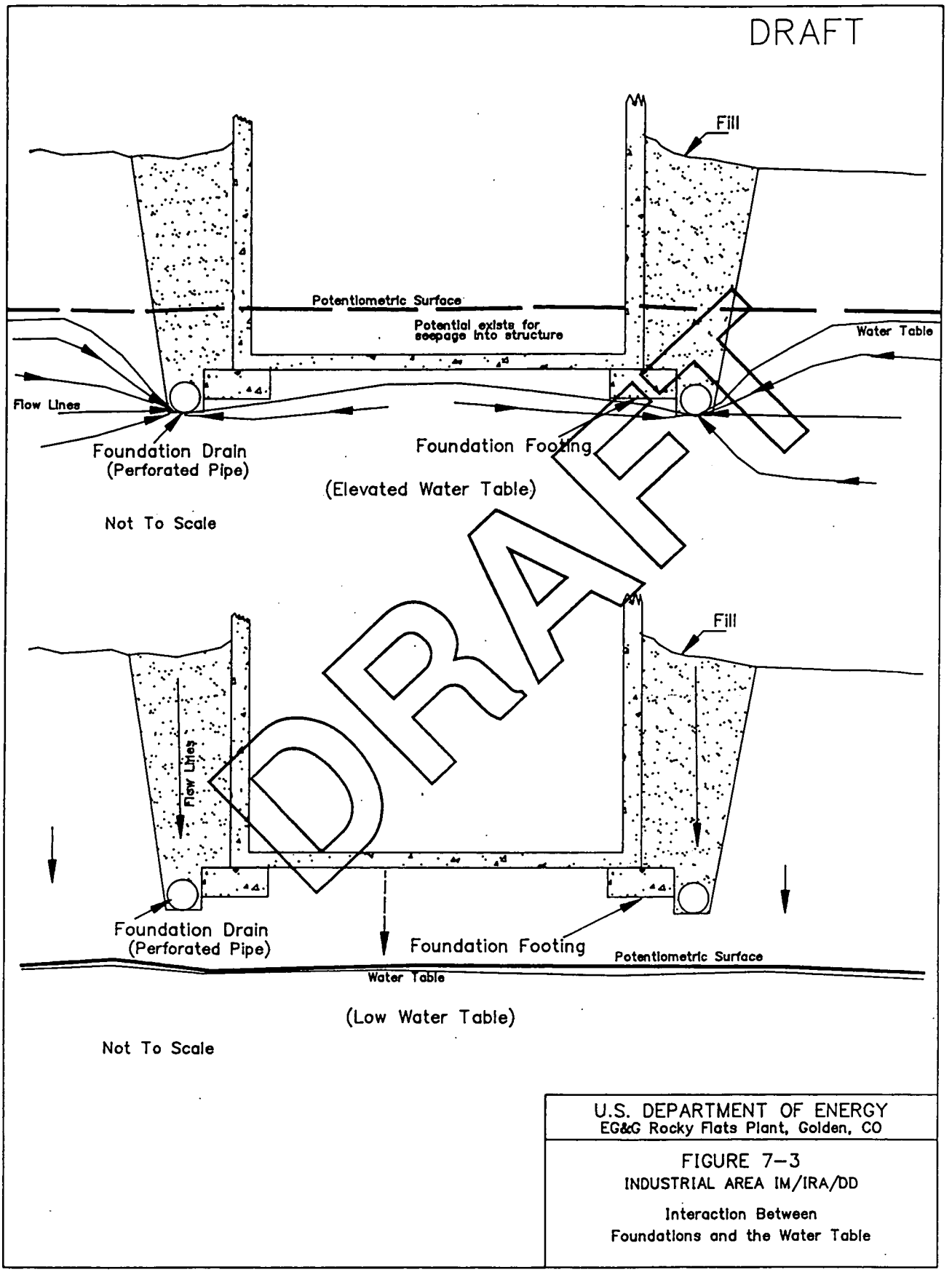
The purpose of having foundation drains is to keep the groundwater level below the foundation. If the drains are installed and operating properly, the groundwater levels should not rise to the level of the building foundation.



U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 7-2
INDUSTRIAL AREA IM/IRA/DD
Typical Foundation Drain

c:\ydata\to\8-2-2.dwg 05H60300



U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 7-3
INDUSTRIAL AREA IM/IRA/DD

Interaction Between
Foundations and the Water Table

c:\rflats\tc\8-2-1.dwg 05H60300

Some of the RFP buildings, including Buildings 774, 776, and 881, have experienced groundwater problems (EG&G 1993z). Building 444/447 also experienced flooding; it is believed that this flooding was a result of partial blockage of storm water pipes in the area that caused a backup of storm water that eventually flooded the basement.

RFP is located geologically on alluvium overlying the Arapahoe Formation (Section 2.2). The Arapahoe Formation is relatively fine grained and generally has a low hydraulic conductivity. New construction often requires the use of fill material around and under foundations. The fill possess a higher hydraulic conductivity than the surrounding hydrostratigraphic unit, thus creating a preferred groundwater flow path. As groundwater levels fluctuate and if the foundation drains are not working properly, the possibility of flooding the foundation, sump, basement, vault, etc. exists. There is also a limited potential for flooding from precipitation infiltrating down through the higher permeability fill along the sides of the foundation. Again, properly working drains should alleviate this potential problem.

A discussion of each building's foundation drains is included in Section 7.5 and Appendix 7.1.

According to the utility and engineering drawings, approximately 20 valve vaults are located in the Industrial Area of the RFP. These vaults may collect groundwater and storm water as well as water that may have leaked from the process waste system pipelines. It is recognized that these waters vary considerably in the type of constituents and that treating them the same may not be appropriate; however, for the purposes of this report and because of the similarity with water from foundation drains, building sumps, and utility pits, all of these waters collectively will be referred to as "foundation waters."

7.3 EXISTING MANAGEMENT, MONITORING, AND DISPOSITION PROGRAMS

The existing programs that relate to the incidental waters and foundation drain waters are outlined in the *Draft Surface Water Management Plan* (EG&G 1992i), the Storm Water Program (Section 5.2), and the *Control and Disposition of Incidental Waters* (EG&G 1993y). These programs are currently considered the best management practices.

The existing management, monitoring, and disposition programs at RFP are discussed in this section.

7.3.1 Management Programs

The draft Surface Water Management Plan provides a long-term program for surface water management and disposition at Rocky Flats. Surface water is currently managed in different ways, depending on the source. Process waste water is treated at the Building 374 treatment facility; nonindustrial waste water is treated at the sanitary waste water treatment plant, which discharges into the B-series ponds and ultimately into Walnut Creek. All treated sanitary waste water, storm water runoff, and some shallow groundwater discharges are stored in one or the other of the series of ponds on the eastern side of the plant before discharging to Big Dry Creek (EG&G 1992i).

Ninety nonstorm water discharge locations have been identified on the Rocky Flats Plant site. Nonstorm water is a term used for waters that do not originate from a precipitation event. Nineteen of the 90 discharge locations at RFP are foundation drains and building sumps in approximately 20 buildings, and the other 71 are utility pits (Hayes 1993). In addition, approximately 20 valve vaults are in the Industrial Area, according to engineering drawing number 37810-057 (Process Liquid Waste Collection and Transfer System, RCRA Permitted Unit #40 1987). The foundation drain waters, for the most part, presently flow into the storm drains or directly into the environment and are not

collected for treatment. The exceptions to this are the water from the 559/561 foundation drain, which is pumped to the sanitary sewer system (EG&G 1993aa); foundation drain water from Building 886, which is sent to Building 374 to be treated in the process waste system; and the water from Building 881, which is collected and sent to the OU1 treatment facility (EG&G 1993bb). Additional areas may be contributing to the water being collected by Building 881, but this information is not known and is currently considered a data gap. Most of the building sumps on the plant site are routed to the process waste treatment facility in Building 374 (Hoffman 1981); however, some of these sumps are not. Information concerning the destinations of the building sumps at RFP has not been available for review and is considered another data gap. Any groundwater that is collected in the process waste valve vaults is also transferred to Building 374 for treatment (EG&G 1993z).

Storm water-related incidental water locations include water collected from berms, pads, manholes, barrels, and various cleanup activities around the Industrial Area. A listing of some of these incidental waters that were collected and sampled from May 1990 through September 1993 are shown in Table 7-1 (EG&G 1993cc). All of these waters listed were sent to Building 374 to be treated in the process waste evaporators. The volume of water collected is not known.

7.3.2 Monitoring

In 1992 and 1993, the waters from foundation drains in Buildings 444, 460 (444-460), 774 (774-1), 371 (371-3 and 371-composite), and 779 (779-1), and the water from the building sumps in Buildings 111 (111-2), 707 (707-2), 865 (865-1), and 883 (883-1) were sampled every quarter, with the sample identification numbers noted in parentheses, to ensure that water discharges did not adversely affect surface water quality (EG&G 1993dd). The quarterly sampling included gross alpha, gross beta, tritium, nitrate, pH, conductivity, TDS, and TAL metals. Volatiles and semivolatiles were added to the

TABLE 7-1
Industrial Area IM/IRA/DD
Incidental Water Locations, Rocky Flats Plant Industrial Area

DATE	LOCATION	LOCATION DESCRIPTION	SOURCE
05/01/90	776 Comp House 904	W side of 776 Building	Condensate In floor drain
05/16/90	PAD 808 Tanks berm	NW corner of the pad (in berm)	Precipitation
06/04/90	790 Manhole 850	Berm NE of 374 Bldg.	Precipitation
06/04/90	Fire Hydrant	Outside Bldg. (Not sure which side)	Groundwater seepage
06/11/90	Manhole NE of 131	Domestic water	Leaking Hydrant
07/17/90	371 Parking lot	NE of 131 Bldg.	Groundwater seepage
07/31/90	771 Roof North 886	Unsure of exact sample location	Precipitation
09/13/90	Park lot manhole	Unsure of exact sample location	Precipitation
09/13/90	886 Park lot	Steam Pit NE of 886 Bldg.	Steam Condensate
09/21/90	manhole 707 CCl4	Steam Pit NE of 886 Bldg.	Steam Condensate
10/04/90	berm 215D Tank 910	Berm N of 707 Bldg.; and S of 776 Bldg.	Precipitation
10/15/90	Bldg #D9 884	W of 970 Bldg.; and S of Solar Ponds	Emergency Fire Water Tank
10/24/90	Barrel #82 884	Probably a barrel inside 910 Bldg.	Not sure
10/26/90	Barrel #67 884	Barrel inside 884 Bldg.	Not sure
10/26/90	Barrel #38 Phone	Barrel inside 884 Bldg.	Not sure
10/26/90	manhole-SW 6th 444	Barrel inside 884 Bldg.	Not sure
10/30/90	Deluge,barrel-1	SW of Sixth Avenue	Groundwater seepage
11/07/90	444	Inside 444 Bldg.	Precipitation
11/07/90	Deluge,barrel-2	Inside 444 Bldg.	Precipitation
11/07/90	444	Inside 444 Bldg.	Precipitation
11/07/90	Deluge,barrel-3	Inside 444 Bldg.	Precipitation
11/07/90	444 Plenum #1 444	Inside 444 Bldg.	Precipitation
11/07/90	Plenum #2 444	Inside 444 Bldg.	Precipitation
11/12/90	Plenum #3 Const.	W of 904 PAD	Precipitation
11/13/90	Site W of 904 771	Inside 771 Bldg.	Precipitation
11/14/90	Deluge Tanks	North of Tent #7	Precipitation
11/27/90	Const. Site N of	East of 886 Bldg.	Precipitation
11/27/90	#7 tent Trench	North of Tent #7	Precipitation
11/28/90	(East 886) Const.	N of 661 Bldg.	Groundwater seepage
02/11/91	Site N of #7 tent	W Truck Dock at 991 Bldg.	Precipitation
02/14/91	Manhole (N of 661)	Not Sure	Not Sure
03/25/91	991 W Dock Manhole	Truck Loading Dock	Precipitation
03/28/91	#8 Bldg 664	Probably a drum inside 666 Bldg.	Not Sure
04/16/91	cleanup Bldg 666	Not Sure	Not Sure
05/20/91	T00042 Manhole #3	Inside 991 Bldg.	Not Sure
05/20/91	N452G Bldg 991	Inside 991 Bldg.	Not Sure
05/22/91	Drum #3 Bldg 991	W Loading Dock at 776 Bldg.	Precipitation
05/30/91	Drum #6 Bldg 776	Secondary Containment around 729 Bldg.	Precipitation
06/04/91	dock west Bldg	NE corner of 444 Bldg.; and S of 452 Trailer	Precipitation
06/04/91	729, elect. berm	Near 991 Bldg.	Precipitation
06/06/91	HNO3 tank berm	S of 554 Bldg.	Groundwater seepage

TABLE 7–1
Industrial Area IM/IRA/DD
Incidental Water Locations, Rocky Flats Plant Industrial Area

DATE	LOCATION	LOCATION DESCRIPTION	SOURCE
07/10/91	B218 Rainwater,	N of 131 Bldg.	Groundwater seepage
07/30/91	Bldg 991	Water Trtmt. Facility In Contractor's Yard	Precipitation
08/01/91	Manhole#2, S of	Near 440 Bldg.	Precipitation
08/02/91	554 Manhole, N of	W of 124 Bldg.	Precipitation
08/05/91	B131 Bldg 891	N of 122 Bldg.	Groundwater seepage
08/29/91	Transformer 440	W of 119 Bldg.	Precipitation
09/03/91	Const site, W 124	Basement of 828 Bldg.	Groundwater seepage
10/01/91	Manhole, N of 122	Inside 991 Bldg.	Not Sure
10/01/91	Const site W 119	Inside 991 Bldg.	Not Sure
10/01/91	Bldg 828 bsmt Bldg	Inside 991 Bldg.	Not Sure
11/26/91	991 drum #1 Bldg	Exact Location unsure of	Groundwater seepage
11/26/91	991 drum #3 Bldg	NE corner of 444 Bldg.; and S of 452 Trailer	Precipitation
11/26/91	991 drum #4 Alarms	NE corner of 444 Bldg.; and S of 452 Trailer	Precipitation
11/26/91	Manhole 4th 218	NE corner of 444 Bldg.; and S of 452 Trailer	Groundwater seepage
11/27/91	acid tank berm, N	Near 729 Bldg. and 705 Bldg.(Berm)	Precipitation
11/27/91	218 acid tank	S of 989 Bldg.; and E of 991 Bldg.	Domestic water line break
12/03/91	berm, S 218	Near 121 Bldg. and 122 Bldg.	Groundwater seepage
01/03/92	basement Elect	Runs on W side of 881 Bldg.	Not Sure
01/06/92	trans. 729/705	881 Hillside	Seep
01/28/92	Excav. Pit, S 989	S of T891A (881 Hillside)	Seep
02/05/92	Manhole, 121/122	French Drain on 881 Hillside	Seep
02/13/92	881 Western	E of 452 Bldg.	Steam Condensate
02/21/92	pipelin OU–1, 881	French Drain on 881 Hillside	Seep
02/21/92	Hillside Water, S	French Drain on 881 Hillside	Seep
02/21/92	T891A French	French Drain on 881 Hillside	Seep
02/21/92	Drain, 881 Steam	French Drain on 881 Hillside	Seep
02/21/92	Pit, E 452 French	French Drain on 881 Hillside	Seep
03/11/92	Drain, STA1400	Steam Pit near 732 Bldg.	Steam Condensate
03/12/92	French Drain,	Drum on Loading Dock at 991 Bldg.	Not Sure
03/17/92	STA2400 French	Underground Tunnel between 561 and 559	Groundwater seepage
03/30/92	Drain, STA3400	Not Sure	Not Sure
03/30/92	French Drain,	Not Sure	Not Sure
04/02/92	STA5400 French	Berm around Transformers at 708 Bldg.	Precipitation
04/02/92	Drain, STA6400 732	Berm around Transformers at 708 Bldg.	Precipitation
04/02/92	Pit 991 E Dock,	Berm around Transformers at 708 Bldg.	Precipitation
04/10/92	Drum #3 561 Tunnel	Berm around transformers E of 115 Bldg.	Precipitation
04/13/92	Effluent Tank 206	S of 764 Bldg.	Groundwater seepage
04/22/92	Effluent Tank 207	Berm in Courtyard of 123 Bldg.	Precipitation
04/22/92	Trans Berm 708–4	Berm in Courtyard of 123 Bldg.	Precipitation
04/22/92	Trans Berm 708–2	Basement of 218 Bldg.	Groundwater seepage
04/22/92	Trans Berm 708–1	NE corner of 444 Bldg.; and S of 452 Trailer	Precipitation

TABLE 7-1
Industrial Area IM/IRA/DD
Incidental Water Locations, Rocky Flats Plant Industrial Area

DATE	LOCATION	LOCATION DESCRIPTION	SOURCE
04/27/92	Trans Berm East	East Loading Dock at 334 Bldg.	Precipitation
04/28/92	115 Manhole South	Berm around Diesel Storage, N of 776 Bldg.	Precipitation
04/28/92	764 Berm #7	Transformer Berm NW of 776 Bldg.	Precipitation
05/04/92	Courtyard 123 Berm	South of 910 Bldg.	Domestic Water line break
05/07/92	#12 Courtyard 123	Probably a barrel, N of 559 Bldg.	Not Sure
05/18/92	Bldg 218 Basement	South of 910 Bldg.	Domestic Water line break
05/26/92	HNO3 Berm North	Transformer Berm Near 116 Bldg.	Precipitation
05/26/92	Second Cont E.	Transformer Berm Near 865 Bldg.	Precipitation
05/26/92	Dock 334 Diesel	Transformer Berm Near 865 Bldg.	Precipitation
05/28/92	Stor Berm N 776	S Side of 444 Bldg	Precipitation
06/02/92	Trans Berm NW 776	Unsure of exact location	Precipitation
06/02/92	Excavation Pit S	NE of 910 Bldg.	Precipitation
06/19/92	of 910 Reject	N of 910 Bldg.; and S of 207B Solar Pond	Precipitation
06/22/92	Waste N559	Transformer Sump NW of 776 Bldg.	Precipitation
06/22/92	Fireline-Bldg 910	N side of 776 Bldg.	Precipitation
06/22/92	Trans. Berm 116-1	Not Sure (Check Plant Map)	Groundwater seepage
06/25/92	Trans. Berm 865-2	E Loading Dock at 991 Bldg.	Precipitation
07/06/92	Trans. Berm 865-1	SE of 371 Bldg.	Steamline Break
07/10/92	Bldg 441-South	N of 121 Bldg.	Groundwater seepage
07/16/92	Side Post holes-B	W of 771 Parking Lot	Groundwater seepage
07/21/92	444 P. lot Exc.	N of Central Avenue; and E of Portal #1	Groundwater seepage
07/21/92	Site NE 910	E of 207B (Solar Pond); NE of 990 Bldg.	Groundwater seepage
08/04/92	Trench, N910/207B	NE of 374 Bldg.	Precipitation
08/11/92	So. Trans. Sump NW	East of 991 Bldg.	Precipitation
08/14/92	776 Diesel fuel	771 Hillside	Precipitation
08/17/92	tank-776	771 Bldg.	Domestic Water
08/26/92	Electrical Pit,	Truck Docks at 904 PAD	Precipitation
11/16/92	E-30 Barrel #1, E	Not Sure	Precipitation
01/24/93	dock 991 Steamline	Sump Pump 559 Bldg.	Groundwater seepage
01/21/93	Break, SE 371	Parking Lot N of Bldg. 864 and Bldg. 865	Precipitation
02/01/93	Electrical Pit,	E of 750 Bldg. and 750 Parking Lot	Precipitation
02/01/93	E-5 Electrical	E of 750 Bldg. and 750 Parking Lot	Precipitation
02/01/93	Pit, E-20	E of 750 Bldg. and 750 Parking Lot	Precipitation
05/26/93	Electrical Pit,	NE of 865 Bldg.	Steam Condensate
03/03/93	E-27 Electrical	Courtyard of 123 Bldg.	Precipitation
03/09/93	Pit, E-29 808 Berm	SW of 664 Bldg.	Valves- Domestic Water
03/09/93	Excavation pit	SW of 664 Bldg.	Valves- Domestic Water
03/09/93	East 991 Trench,	S of 127 Bldg.	Valves- Domestic Water
03/09/93	771 Hillside	W of 707 Bldg.	Valves- Domestic Water
03/15/93	Fireline Clapper	In Tunnel Between 559 Bldg. and 561 Bldg.	Groundwater seepage
03/15/93	Valve Unit 15 at	In Tunnel Between 559 Bldg. and 561 Bldg.	Groundwater seepage

TABLE 7–1
Industrial Area IM/IRA/DD
Incidental Water Locations, Rocky Flats Plant Industrial Area

DATE	LOCATION	LOCATION DESCRIPTION	SOURCE
03/18/93	904 PAD N 2nd	SE of 551 Bldg. (Near Fire HYdrant)	Valves– Domestic Water
03/22/93	Berm–Truck Yard	W of 771 Parking Lot	Groundwater seepage
03/25/93	Bldg 559 Sump	In Tunnel Between 559 Bldg. and 561 Bldg.	Groundwater seepage
03/25/93	Parking Lot N of	Between 561 Bldg. and 559 Bldg.	Groundwater seepage
03/25/93	Bldgs 864/865	Near 707 bldg. and 778 Bldg.	Precipitation
04/29/93	Haliburton equip,	W of 207A Solar Pond	Groundwater
05/13/93	berm #2 Haliburton	N of 910 Bldg.	Precipitation
05/26/93	equip, berm #3	Near 707 bldg. and 778 Bldg.	Precipitation
06/03/93	Haliburton equip,	W Loading Dock at 991 Bldg.	Precipitation
06/03/93	berm #4 Steam Pit	W Loading Dock at 991 Bldg.	Precipitation
06/03/93	NE of Bldg 865 123	W Loading Dock at 991 Bldg.	Precipitation
06/14/93	Scrubber berm	W of 910 Bldg.; and S of Solar Ponds	Emergency Fire Water Supply
06/21/93	Buffalo Box #1,	N side of 910 Bldg.	Precipitation
06/29/93	TC–051063 Buffalo	W of 910 Bldg., and S of Solar Ponds	Precipitation
07/29/93	Box #2, TC–051063	On Hillside N of PA	Not Sure
09/08/93	Buffalo Box	N side of 910 Bldg.	Precipitation
09/14/93	TC–019797,S127	NW of 708 Bldg. and S of 707 Bldg.	Precipitation
09/17/93	Buffalo Box	444 Bldg.	Groundwater
09/20/93	TC–051445,W707	NE of 569 Bldg.	Steam Condensate
34235	Sump between	Alarm Sys. manhole on Cant, S of Port 1	Groundwater Seepage

Source: EG&G 1993cc.

sampling program in July of 1992 (EG&G 1993ee). The results from this quarterly sampling are currently being evaluated as part of the OU8 project.

Incidental water on the ground surface within an area of concern (areas with known contamination or within IHSSs) is collected (not necessarily before sampling), sampled, and characterized. Most secondary containment systems have leak detection capabilities and incidental water in these areas is removed from the containment systems and treated. Otherwise, it is considered not contaminated and allowed to evaporate, run off as surface water, or infiltrate into the ground and is managed under current surface water practices.

Data about the sampling of the foundation drains and building sumps have not been extensively researched because this information is being researched under the OU8 project, but selected results from aperiodic sampling of foundation drains and building sumps in the industrial area are shown in Table 7-2. These results represent those analytes that were detected above background levels.

Foundation drains sampled in the aperiodic sampling (1992-1993) mentioned in the previous paragraph include the following:

FD-111-1	FD-559-561	FD-883-1
FD-371-3	FD-707-1	FD-886-1
FD-371-COMP	FD-771-1	FD-886-2
FD-371-MC	FD-774-1	FD-910
FD-444-460		

Building sumps sampled in the aperiodic sampling (1992-1993) mentioned above include the following:

BS-707-1	BS-865-2	BS-707-2
BS-883-1	BS-865-1	

TABLE 7-2
Industrial Area IM/IRA/DD
Selected Results of Elevated Detections from the Aperiodic Sampling of Building Sumps and Foundation Drains at Rocky Flats Plant

Selected Analytes (1992, 1993)

LOCATION ID	DATE	YEAR	ANALYTE	RESULT (μg/L)
FD-371-3	3/27	1993	Iron	3,110
			Manganese	357
			Strontium	1,040
FD-444-460	3/27	1993	Aluminum	1,710
			Iron	918
FD-559-561	7/25	1992	Mercury	0.68
			1,1-Dichloroethene	48
			Carbon Tetrachloride	220
			Chloroform	6
			Tetrachloroethene	15
			Trichloroethene	160
FD-559-561	3/9	1993	1,1,2,2-Tetrachloroethane	23
			1,1-Dichloroethane	6
			1,1-Dichloroethene	74
			1,2-Dichloroethene	17
			Carbon Tetrachloride	320
			Chloroform	8
			Trichloroethene	160
BS-707-2	3/7	1992	Gross Beta	45 pCi/L
BS-707-2	3/27	1993	Gross Beta	61 pCi/L
FD-771-1	5/1	1993	Aluminum	619
			Gross Beta	16 pCi/L
			Carbon Tetrachloride	43
			Chloroform	45
FD-774-1	3/27	1993	Aluminum	2,580
			Iron	1,840
			Gross Beta	15 pCi/L

Table 7-2
Industrial Area IM/IRA/DD
Selected Results of Elevated Detections from the Aperiodic Sampling of Building Sumps and Foundation Drains at Rocky Flats Plant
Page 2

Selected Analytes (1992, 1993)

LOCATION ID	DATE	YEAR	ANALYTE	RESULT (µg/L)
BS-865-2	3/27	1993	Aluminum	564
			Manganese	93.2
			Iron	835
			Strontium	789
			Gross Alpha	12 pCi/L
BS-883-1	3/7	1992	Aluminum	1,790
			Iron	1,450
FD-883-1	5/1	1993	Strontium	879
			Tetrachloroethene	6
FD-886-1	5/1	1993	Gross Alpha	16 pCi/L
FD-886-2	5/1	1993	Gross Alpha	12 pCi/L
FD-910	5/1	1993	Chloroform	20

BS = Building Sump
FD = Foundation Drain
pCi/L = picocuries per liter
µg/L = micrograms per liter

Based on these selected data, some analytes may occasionally exceed the water quality standards that are currently being proposed at RFP.

These sampling locations are identified as nonstorm water discharges. Nonstorm water discharge locations in the RFP Industrial Area as of the spring of 1993 are shown in the April 1993 EG&G report entitled *Non-Storm Water Discharge Locations and Sampling at Rocky Flats* (EG&G 1993dd).

The flow rates from these foundation drains and building sumps were not measured except for data from the 881 Hillside. Flow rate information is estimated because of flowmeter calibration problems (EG&G 1993ff). The Rocky Flats OU1 managers were able to give the following estimated average flow rates:

881 FLOW READINGS (EG&G 1993ff)

January, February	~4.0 - 4.25 gallons per minute (gpm)
March, April, May	~7.0 gpm
June, July, August, September, October	~2.3 gpm
November, December	~3.5 gpm

Although these flow rates are estimates, seasonal variations exist. The lack of detailed flow data is also considered a data gap.

7.3.3 Disposition Plan

Until recently, there has not been an approved written procedure concerning the disposition of incidental waters at RFP, although a written draft procedure has been used since May 1990 (EG&G 1993cc). The plantwide approved Control and Disposition of Incidental Waters (CDIW) procedure became effective on September 6, 1993 (EG&G

1993y). This document includes examples of the forms that will be filled out and filed with the Surface Water Division. The CDIW is discussed below.

The CDIW document was written to provide the requirements for the control and disposition of incidental waters originating from construction activities; natural collection on the ground surface; collection of water in secondary containment systems, pits, and vaults; and the discharge of water from the Fire Suppression System. The CDIW does not include requirements for control or disposition of foundation waters in foundation drains, building sumps, or basements. Waters originating from drinking water sources or as runoff from precipitation events that have no possibility of contamination are excluded from the requirements outlined in this procedure and are discharged directly into the environment.

The CDIW procedure gives detailed lists of responsibilities and instructions for each involved party for identifying, sampling, collecting, and containing incidental waters. It is recommended that the CDIW be enhanced by each outfall being monitored and collected until the waters can be characterized and an appropriate disposition method can be determined from sampling results. During periods when treatment facilities are running at capacity, a storage facility on the RFP site may be used to store incidental waters.

After the incidental waters have been collected, the CDIW requires that the water be tested and compared to control limits to determine a proper method of disposition. Control limits have been established for gross alpha, gross beta, pH, nitrates, and conductivity only. These parameters were selected as indicative of general water quality and assumed adequate to determine if more detailed analysis for specific parameters is warranted. To be conservative, most incidental waters are sent to Building 374 for treatment. Because no limits for metals, organics, TDS, or any other chemical compound are specified in the CDIW, it is recommended that a Total Toxic Organics (TTO) test be added to the CDIW to establish an indicator test for organics.

Additionally, control limits should be set on the other chemicals of potential concern (Section 3.0).

If the incidental waters test below the control limits, they are discharged directly to the ground or into a storm drain. If they test above the limits, they are contained and stored until they can be treated in Building 374 or 774, or until additional characterization determines that it would be appropriate to treat the waters at the Sewage Treatment Plant (STP). Recommendations for other possible treatment alternatives available at RFP and possible treatment technologies are discussed in Section 7.6.

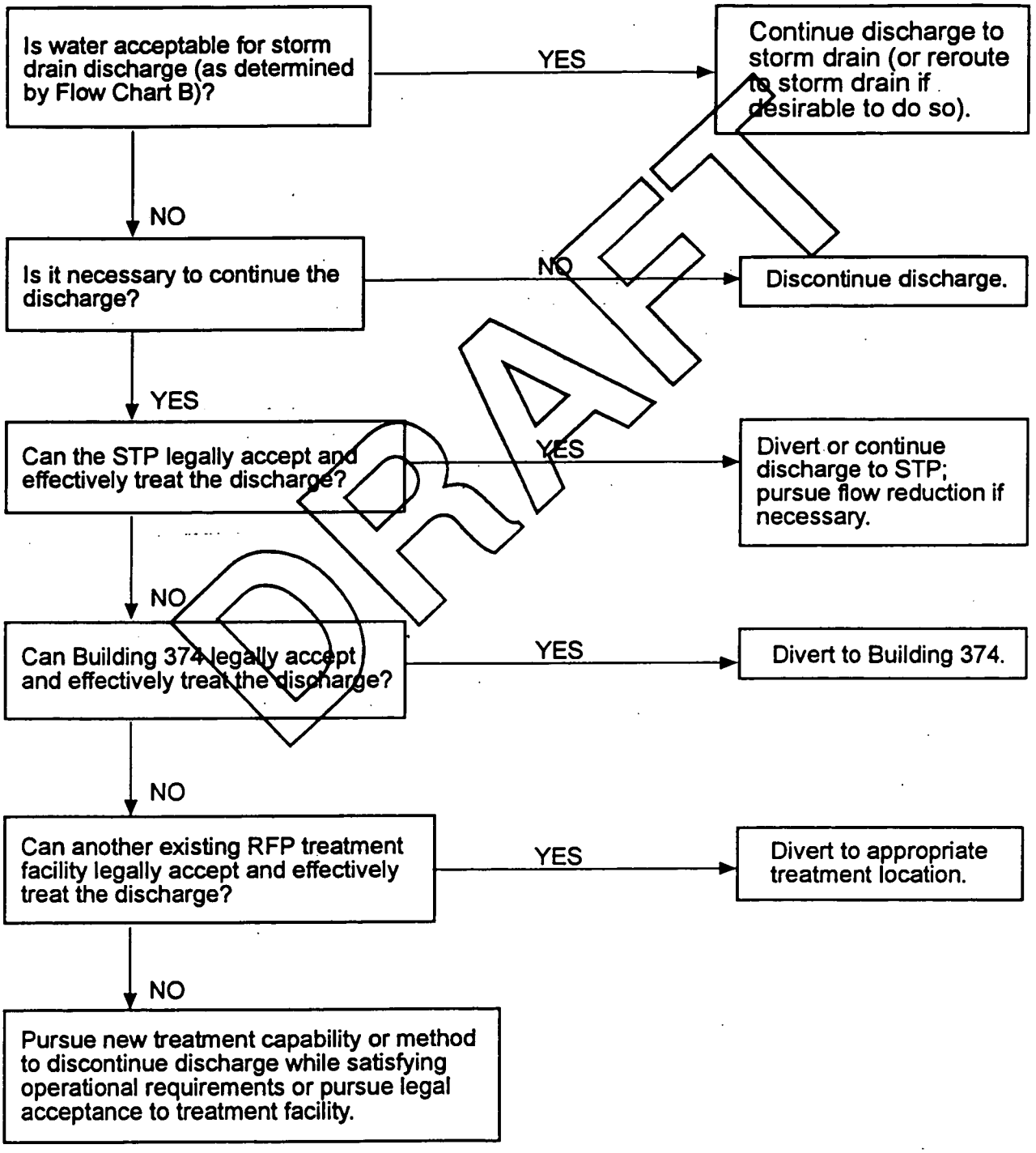
A draft position paper was prepared by the EG&G Surface Water Division as requested by the RFO for the management of foundation drains, utility pits, and other incidental water discharges to the surface waters at RFP on May 13, 1993. Figures 7-4 and 7-5 are flow diagrams that were proposed in response to this request. Chart A details the "big picture" of determining discharge routing, and Chart B serves as a guide for determining suitability of foundation water discharges to surface water (EG&G 1993gg).

7.4 SUMMARY OF AVAILABLE DATA

Because of the large amount of data available concerning RFP, it was necessary to set priorities as to which documents would be key in evaluating the current water management program and potential water treatment technologies. The first document evaluated was the August 12, 1993 draft *Control and Disposition of Incidental Waters* written by EG&G Surface Water Division (EG&G 1993y). This document led to other documents and sources of information. The documents that were reviewed for this section and the general content of each is listed in Table 7-3. These documents are listed alphabetically according to their titles, not in the order that they were reviewed.

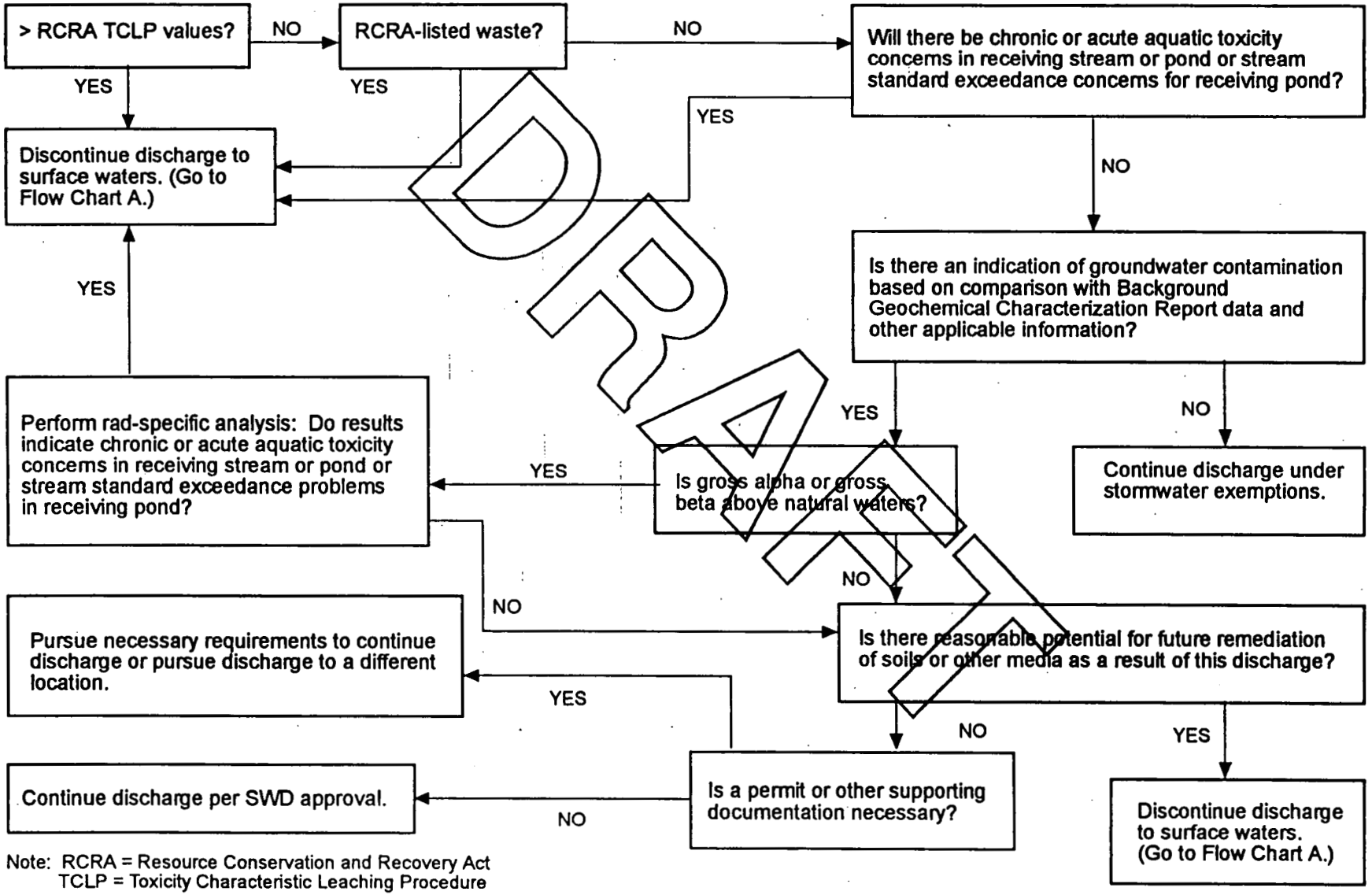
Performance meetings among EG&G, CDH, DOE, and EPA were held bi-weekly throughout the course of the project. The purpose of these meetings was to allow the

FIGURE 7-4
Industrial Area IM/IRA/DD
Flow Chart A: Routing Determination
for Foundation Drain and Utility Pit Discharges



STP = sewage treatment plant
Source: (EG&G 1993gg)

FIGURE 7- 5
Industrial Area IM/IRA/DD
Flow Chart B: Surface Water Discharge Determination for Foundation Drains and Utility Pits



Note: RCRA = Resource Conservation and Recovery Act
TCLP = Toxicity Characteristic Leaching Procedure

Source: (EG&G 1993gg)

TABLE 7-3
Industrial Area IM/IRA/DD
Selected Incidental Water References Collected
for the Rocky Flats IM/IRA/DD

DOCUMENT	INFORMATION/LEVEL
A Description of Rocky Flats Foundation Drains. (Yashan and Barros 1992)	Foundation drain locations
Analysis of Precipitation Occurrences in Los Alamos, New Mexico, for Long-Term Predictions of Waste Repository Behavior. (Nyhan 1989)	Meteorology of Los Alamos, N/A
Annual Report for Treatability Studies at Rocky Flats Plant, Fiscal Year 1991. (DOE 1992f)	Different test treatments Very good information
Annual Report for Treatability Studies at Rocky Flats Plant, Fiscal Year 1992. (DOE 1993)	Updated test treatments Very good information
Catalogue of Monitoring Activities. (EG&G 1991h) Tables 4-9 & 4-12.	Sec. 4-Foundation Drain, Building Sump, Incidental Waters monitoring summaries
Demonstration of the Colloid Polishing Filter Method. Program Fact Sheet. (EPA 1993b)	Test of CPFM
Design and Engineering of the UMTRA Mobile Waste Treatment Plant. (Conroy 1989)	Design specifications for treatment designed by AIChE
Engineering Evaluation/Cost Analysis for the Proposed Management of Contaminated Structures at the Weldon Spring Chemical Plant. (DOE 1991c)	List of decommissioning and disassembling activities
Environmental Constituents in the Rocky Flats Area-Non Facility Related Sources Pertinent to Water Quality. (Morgan 1990)	Nonpoint source water quality
Evaluation of Treatment Alternatives for Storm Water in Ponds A-4, B-5, and C-2: Final Report. (IT 1990)	Twelve alternatives for treating RFP pond water
Final Phase Work Plan for OU9. (Jacobs 1993b)	Chemicals of concern

TABLE 7-3 (Continued)

DOCUMENT	INFORMATION/LEVEL
Final Safety Analysis Report - Building 774. (EG&G 1987)	Building 774 treatment UCNI document
Guide to Treatment Technologies for Hazardous Wastes at Superfund Sites. (EPA 1989a)	Biological, chemical, physical, and thermal treatments
Hydrology of a Nuclear Processing Plant Site. (Hurr 1976) Sections 2.3 and 2.6	Basic geologic/hydrologic information
Installation Work Plan for Environmental Restoration Clean-up Program. Vol. 1. (LANL 1992a)	Describes RCRA Facility Investigation, CMS, CMI, technical process
Installation Work Plan for Environmental Restoration Clean up Program. Vol. 2. (LANL 1992b)	N/A
Low-Level Integrated System Test. (LANL 1986)	N/A
Non-Storm Water Discharge Locations and Sampling at Rocky Flats. (Hayes 1993)	Drain locations
Operational Safety Analysis (OSA) for Building 374 Evaporators. (EG&G 1992o)	Building 374 evaporators
Operational Safety Analysis (OSA) for Building 910 Evaporators. (EG&G 1993i)	Building 910 evaporators
Proposed IM/IRA/DD for the Solar Evaporation Ponds, OU4. (EG&G 1992p)	Solar pond/Interceptor Trench System information
Rocky Flats Surface Water Monitoring Program. (EG&G 1992i)	Surface water management Water quality standards
Sampling and Analysis Plan, Surface Water IM/IRA, South Walnut Creek Basin OU2, Granular Activated Carbon Treatment System. (EG&G 1991i)	N/A
Summary of Technologies for Remediation of Aquifers. (Keddy 1989)	Methods for remediation of aquifers

TABLE 7-3 (Continued)

DOCUMENT	INFORMATION/LEVEL
Ultrox International Ultraviolet Radiation/Oxidation Technology: Applications Analysis Report. (EPA 1990)	Information on skid-mounted oxidation treatment
Water Management Alternatives for the Rocky Flats Plant. (ASI 1988)	Information on treatments Contains regulations and NPDES permit information Possibly old information
Work Plan for Field Treatability Study, South Walnut Creek Basin Surface Water IM/IRA. (EG&G 1991j)	OU2 treatment capability
Sanitary Sewer Infiltration/Inflow and Exfiltration Study: RFP: **Task 1** of the Zero-Offsite Water-Discharge Study. (ASI 1991b)	Water balance for sewer system, manhole information, water usage
Non-Point Source Assessment and Storm-Sewer Infiltration/Inflow and Exfiltration Study: RFP: **Tasks 2&3** of the Zero-Offsite Water-Discharge Study. (ASI 1991c)	Quantity/quality study for STP and nonsource points
Solar Ponds Interceptor Trench System: Groundwater Management Study, RFP: **Task 7** of the Zero-Offsite Water-Discharge Study. (ASI 1991d)	Interceptor Trench Pump House flow estimates and balances, groundwater management, concentrations of chemicals of concern, treatment alternatives
Sanitary Treatment Plant Evaluation Study: RFP: **Task 10** of the Zero-Offsite Water-Discharge Study. (ASI 1991e)	Good current STP information, recommendations
Reverse Osmosis and Mechanical Evaporation Study: RFP: **Task 12** of the Zero-Offsite Water-Discharge Study. (ASI 1991f)	Reverse Osmosis pretreatment information
Surface Water Evaporation Study: RFP: **Task 15** of the Zero-Offsite Water-Discharge Study. (ASI 1991g)	Calculations, ~45" total evaporation each year from the ponds at RFP

TABLE 7-3 (Continued)

DOCUMENT	INFORMATION/LEVEL
Alternatives to Zero Discharge: **Task 17** of the Zero-Offsite Water-Discharge Study. (ASI 1991h)	Off/onsite water release/use alternatives for Sewage Treatment Plant, storm water, groundwater, no treatments
Report on Drain Investigations: RFP: **Task 18** of the Zero-Offsite Water-Discharge Study. (ASI 1991i)	Information on two ongoing studies: NPDES Drain Verification Activity and Drain Identification Study
Raw, Domestic and Industrial Water Pipeline Leak-detection Method Study: **Task 20** of the Zero-Offsite Water-Discharge Study. (ASI 1991j)	Leak detection methods, N/A
Temporary Water Storage Capabilities Study: **Task 21** of the Zero-Offsite Water-Discharge Study. (ASI 1991k)	Considers onsite storage relative to zero discharge, water shed yield equation
Feasibility of Groundwater Cutoff/Diversion Study **Task 26** of the Zero-Offsite Water-Discharge Study. (ASI 1991l)	Secondary scope, 4 alternatives for reducing groundwater flow, no supporting documentation included

AIChE = American Institute of Chemical Engineers
ASI = Advanced Sciences, Inc.
CMI = Corrective Measures Implementation
CMS = Corrective Measures Study
CPFM = Colloid Polishing Filter Method
DOE = U.S. Department of Energy
EPA = U.S. Environmental Protection Agency
IM = Interim Measures
IRA = Interim Remedial Action
IT = IT Corporation
LANL = Los Alamos National Laboratory
N/A = Not Applicable
NPDES = National Pollutant Discharge Elimination System
OSA = Operational Safety Analysis
OU = Operable Unit
RFP = Rocky Flats Plant
STP = sewage treatment plant
UCNI = Unclassified Controlled Nuclear Information
UMTRA = Uranium Mill Tailings Remedial Action

groups to exchange information and ensure that the project was fully understood by all parties involved. These meetings provided information about additional documents, personnel, and other sources of information for the research into incidental waters, foundation drains, and current practices at RFP.

Personal interviews were conducted to confirm information concerning current Rocky Flats treatments, foundation drain locations, and the ongoing Drain Identification Study (DIS) (EG&G 1993hh). Surface Water Division personnel were also interviewed for information that may have been overlooked.

Additionally, it was necessary to accurately locate each of the foundation drains, building sumps, valve vaults, and utility pits that could potentially intersect the groundwater. Engineering drawings (Table 7-4) were reviewed in detail to evaluate the effect the foundation drains could have on groundwater. The information from these drawings was then compiled into Figure 7-1 and Figures A-1 through A-14 in Appendix 7.1.

7.5 CONTAMINANTS, SOURCES, AND PATHWAYS

The constituents that could potentially be transported in the incidental waters vary among locations within the plant site. This variability is also dependent on the foundation structure, housekeeping in the building, any possible contamination under the building, hazardous materials contained within the building, and the condition of the building foundation. Sources of contamination can be spills, historical releases, contamination under the building, and buried materials in the area.

Backfill material around the foundation drains is a potential conduit for groundwater migration because of the fill material being more highly permeable than the naturally occurring surrounding materials. Therefore, the fill material is a possible contaminant pathway. Foundation drains can also be considered potential pathways for contaminant

TABLE 7-4
Industrial Area IM/IRA/DD
Foundation Drains and Foundations Drawings Cross-Reference

BUILDING	DRAWING NUMBER	COVERAGE
111	D-14140-1	FOUNDATION PLAN
	D-25581-8	FOUNDATION DRAIN PLAN
	RF-11-F-1-C	FOUNDATION AND BASEMENT PLAN SCHEDULE AND DETAILS
	RF-11-S-1-C	FIRST FLOOR PLAN (SOUTH) AND FOUNDATION PLAN
	D-11508-21	GRADING PLAN
	D-11508-22	GRADING PLAN
	D-1-1664-11	BASEMENT FLOOR PLAN (SOUTH)
	D-1-1665-11	BASEMENT FLOOR PLAN (NORTH)
	15501-27	SITE UTILITY PLAN
121/122	D-21641-11	FOUNDATION PLAN
	D-1-13122-21.22	FOUNDATION PLAN AND DETAILS
123	D-1-11588-23	FOUNDATION PLAN
	D-1-11589-23	FOUNDATION DETAILS
	D-20712-2	PLOT AND DRAINAGE PLAN
	D-1-11588-23	FOUNDATION PLAN
	D-1-11589-23	FOUNDATION DETAILS
	D-1-11571-23	TOILET ROOM LAYOUT AND SOURCE VAULT DETAILS
	RF-23-101	PLUMBING, SERVICE PIPING, AND DRAINS
124	D-25581-3	FOUNDATION DRAIN PLAN
	RF-24-109-B	OUTFALL SEWER
	RF-24-F1-C	FOUNDATION PLAN
	RF-24-Y1-B	PLOT PLAN AND GRADING
	27006-4	BACKWASH STORAGE TANKS LAYOUT
125	D-20712-16	PLOT AND DRAINAGE PLAN
	D-28540-4	SITE PLAN AND DRAINAGE
	D-28540-8	FOUNDATION PLAN
	D-28540-10	FOUNDATION SECTIONS
	D-14482-1	FOUNDATION, FLOOR PLAN, AND DETAILS
	D-14482-2	FOUNDATION AND SLAB DETAILS
331	D-15972-3	FOUNDATION AND SECOND FLOOR FRAMING PLANS
	RF-31-F1-C	GROUND FLOOR AND FOUNDATION PLAN
	RF-31-S2	FOOTING AND DETAILS
371/374	D-25032-23	PLUTONIUM RECOVERY SUBDRAINS AND FILL SECTIONS
	D-25032-29	PLUTONIUM RECOVERY SUBDRAINS AND FILL SECTIONS
	D-25032-30	PLUTONIUM RECOVERY SUBDRAIN AND FILL SECTIONS
	D-25032-31	PLUTONIUM RECOVERY SUBDRAIN AND FILL SECTIONS
	D-25032-32	PLUTONIUM RECOVERY SUBDRAIN AND FILL SECTIONS
	D-25032-35	PLUTONIUM RECOVERY AND WASTE TREATMENT DETAILS
	D-25032-33	PLUTONIUM RECOVERY SUBDRAINS AND FILL SECTIONS
	D-25042-49	PLUTONIUM RECOVERY SUBDRAINS AND PROFILE

TABLE 7-4
Industrial Area IM/IRA/DD
Foundation Drains and Foundations Drawings Cross-Reference

BUILDING	DRAWING NUMBER	COVERAGE
371/374	D-25042-50	PLUTONIUM RECOVERY SUBDRAIN DETAILS
(cont'd.)	D-25022-4	AREA PLOT PLAN FOUNDATION AND STORM DRAINS
	B-25025-15	SUB BASEMENT PLUMBING DRAWING INDEX
	D-30371-1-1E	SUB BASEMENT FLOOR PLAN
	D-30371-2-1H	BASEMENT FLOOR PLAN
	D-37487-200	FOUNDATION PLAN BLDG 374
400 AREA	15501-52	SITE UTILITY PLANS
439	D-2134/1-11	FOUNDATION AND FLOOR SECTIONS AND DETAILS
	D-2134/1-12	FOUNDATION AND FLOOR SECTIONS AND DETAILS
440	D-21341-1	FOUNDATION AND FLOOR SLAB PLAN
	D-21341-2	FOUNDATION WALL ELEVATIONS
	D-21341-3	FOUNDATION AND FLOOR SLAB SECTIONS AND DETAILS
	D-21341-4	FOUNDATION SECTIONS
	D-21341-5	MISCELLANEOUS SECTIONS AND DETAILS
441	RF-41-F1-B	FOUNDATION PLAN AND DETAILS
	RF-41-F2-B	FOUNDATION DETAILS AND SECTIONS
	RF-41-Y1-B	PLOT PLAN
	D-21641-31	ADDITION AND RENOVATION FOUNDATION PLAN
	D-21641-32	ADDITION AND RENOVATION FOUNDATION SECTIONS AND DETAILS
442	RF-42-F1-B	COLUMNS AND FOUNDATION PLAN
	RF-42-Y1-B	PLOT PLAN
	D-26693-3	HEPA BLDG STORAGE – FOUNDATION AND PLAN
444/447	D-13608-44	FOUNDATION PLAN AND DETAILS
	D-RF-47-F1	FOUNDATION PLAN AND DETAILS
	D-RF-44-F3	FOUNDATION PLAN AND DETAILS
	D-25581-4	FOUNDATION DRAIN
	RF-44-Y1	PLOT PLAN BLDG 444
	RF-44-107	PROCESS WASTE DETAILS, BASEMENT BLDG 444
	RF-44-F2	FOUNDATION SCHEDULE AND DETAILS
	D-1-3326-47	FLOOR TRENCHES AND UNDERGROUND PIPING
	RF-44-109-F	SUMP PUMPS – DETAILS AND SECTIONS
	RF-44-126-G	PROCESS AND SERVICE PIPING RMS – 1 and 2
	1-6540-44	PROCESS AND SERVICE PIPING
	1-3184-44	PROCESS WASTE FILTRATION SYSTEM
460	D-36010-459	MECHANICAL PIPING
	D-36010-453	MECHANICAL PIPING
	D-36010-452	UNDERGROUND PIPING
	28646-3	AREA UTILITIES LOCATION
	36010-100	STORM DRAIN LAYOUT
	D-36010-300	FOUNDATION LAYOUT

TABLE 7-4
Industrial Area IM/IRA/DD
Foundation Drains and Foundations Drawings Cross-Reference

BUILDING	DRAWING NUMBER	COVERAGE
460 (cont'd.)	D-36010-301	FOUNDATION LAYOUT
	D-36010-302	FOUNDATION SCHEDULE AND DETAILS
	D-36010-304	VAULT PLANS
	D-36001-304	CNNMF FOUNDATION LAYOUT
	D-36001-305	CNNMF FOUNDATION SECTIONS
515/516	D-20843-1	SUBSTATION 515/516 PLAN AND SECTIONS
	D-20843-2	SUBSTATION 515/516 SECTIONS AND DETAILS
559	D-21412-01	PLOT AND DRAINAGE PLAN
	RF-AY-14028-4	TUNNEL PLAN AND DETAILS
	RF-AY-14027-3	SITE DETAILS SHEET 1
	RF-AY-14027-6	SITE DETAILS SHEET 4
	RF-AY-14028-1	FOUNDATION PLAN
	RF-AY-14028-3	FOUNDATION AND ROOF DETAILS
	RF-AY-14028-7	SCHEDULES
701	D-17940-1	MAINTENANCE SHOPS PLAN AND DETAILS
	D-17940-3	MAINTENANCE SHOPS PLAN AND DETAILS
707	RF-BZ-20451-5	PLUMBING PLAN - UNDERGROUND PART A
	RF-BZ-20451-6	PLUMBING PLAN - UNDERGROUND PART B
	RF-BZ-20451-7	PLUMBING PLAN - UNDERGROUND PART C
	RF-BZ-20451-8	PLUMBING PLAN - UNDERGROUND PART D
	RF-BZ-20451-9	PLUMBING PLAN DETAILS
	20220-12	UTILITY PLANS
	20220-8	UTILITY PLANS
	20220-6	UTILITY PLANS
770	D-13554-1	MODIFICATIONS TO BUILDING STRUCTURAL DETAIL
771	D-15754-1	FOUNDATION PLAN AND DETAILS
	D-RF-71-F1	FOUNDATION PLAN AND DETAILS
	D-RF-71-S7	FOUNDATION PLAN AND DETAILS
	D-19604-1	FLOOR PLAN
	D-25581-5	FOUNDATION PLAN
	RF-71-113-D	PLOT PLAN, SEWER AND DRAINAGE LINES
	RF-71-111-C	SANITARY, PROCESS, AND STORM DRAIN PROFILES
	RF-71-102-E	NORTHEAST AREA FIRST FLOOR UNDERGROUND PLUMBING
	RF-71-104-G	SOUTHEAST AREA FIRST FLOOR UNDERGROUND PLUMBING
	RF-71-116-C	ARRANGEMENT OF HOLDING TANKS
	RF-V71-10008	FOUNDATION PLAN SECTIONS AND DETAILS OF ADDITION
	RF-71-101	NW AREA UNDERGROUND PLUMBING
	RF-71-103	SW AREA UNDERGROUND PLUMBING
	7387-2	UNDERGROUND PLUMBING

TABLE 7-4
Industrial Area IM/IRA/DD
Foundation Drains and Foundations Drawings Cross-Reference

BUILDING	DRAWING NUMBER	COVERAGE
731	D-50095-101	SECONDARY CONTAINMENT DETAILS
774	D-RF-V74-10012	FOUNDATION PLANS
	D-23542-103	GRADING PLAN
	D-25581-6	FOUNDATION DRAIN PLAN
	RF-74-1-G	PLANS AND ELEVATIONS
	RF-74-S1-D	FOUNDATION, FLOOR, AND ROOF PLAN
	D-23542-202	GRADING AND UTILITY PLAN
	14773-2	WASTE DISPOSAL FACILITY PLOT PLAN
	29655-470	BLDG. 774 SUB GRADE DRAIN PUMP CASING DETAILS
	37728-002	WASTE TREATMENT ADDITION ENLARGED SITE PLAN
	37728-014	WASTE TREATMENT ADD. FOUNDATION AND WALL SECTIONS
	38544-X10	UTILITY DEMOLITION PLAN
776	D-15232-1	FOUNDATION PLAN ADDITIONS AND ALTERATIONS
	D-15232-2	FOUNDATION SECTIONS AND DETAILS
	RF-76-17202	FOOTING SCHEDULE AND DETAILS
	D-12571-2	BASEMENT PLAN AND SECTIONS
	D-1-13324	FOUNDATION PLAN
777	D-14505-1	FOUNDATION AND FLOOR PLAN SECTIONS, REMODEL AND ADDITION
	RF-AP-77-B1	EAST ADDITION FOUNDATION AND FIRST FLOOR PLAN
	RF-77-17305-4	CONCRETE FIRST FLOOR PLAN
	D-25581-1	FOUNDATION DRAIN PLAN – DRAIN TERMINATING POINTS
	D-1-11142-77	MISC. FOUNDATION DETAILS SHEET 1
	D-1-11143-77	MISC. FOUNDATION DETAILS SHEET 2
	D-14584-1	FOUNDATION AND FIRST FLOOR PLAN ADDITION
778	D-11324-8	FOUNDATION PLAN
	D-11324-9	FOUNDATION PLAN
	D-14991-1	SITE PLAN, FOUNDATION PLAN AND DETAILS
779	D-20112-04	GRADING AND DRAINAGE PLAN
	D-20143-01	FOOTING SCHEDULE
	D-20143-02	FOUNDATION DETAILS
	D-20143-03	FOUNDATION DETAILS
	D-20142-01	FOUNDATION PLAN
	D-25581-7	FOUNDATION DRAIN PLAN
	E-14607-2	FOUNDATION AND FIRST FLOOR PLAN
	E-14608-1	COLUMN AND FOOTING SCHEDULES
	E-14608-2	BASEMENT SLABS SECTIONS AND DETAILS
850	28234-103	SITE PLAN
	28234-106	FIRST FLOOR PLAN
	28234-309	PLUMBING SITE PLAN

TABLE 7-4
Industrial Area IM/IRA/DD
Foundation Drains and Foundations Drawings Cross-Reference

BUILDING	DRAWING NUMBER	COVERAGE
865	D-21112-1	PLOT AND DRAINAGE PLAN
	D-21112-2	PLOT AND DRAINAGE PLAN
	D-21112-3	PLOT AND DRAINAGE PLAN
	D-21141-3	FOUNDATION AND FLOOR SLAB PLAN PART A
	D-21141-4	FOUNDATION AND FLOOR SLAB PLAN PART B
	D-21141-5	FOUNDATION AND FLOOR SLAB PLAN PART C
	D-21141-6	FOUNDATION AND FLOOR SLAB PLAN PART D
	D-21141-7	FOUNDATION AND FLOOR SLAB PLAN PART E
	D-21141-8	FOUNDATION AND FLOOR SLAB PLAN PART F
	D-21151-3-C	OFFICE ABOVE GROUND PLUMBING PLAN
	D-21151-4-A	GENERAL SHOP AREA UNDERGROUND PLAN
	D-21151-5-B	GENERAL SHOP AREA ABOVE GROUND PLUMBING PLAN
	D-21143-7-A	PROCESS WASTE PIT PLAN AND SECTIONS
881	D-50026-100	DRAINAGE DITCH IMPROVEMENTS
	D-RF-81-F1	FOUNDATION PLAN
	D-RF-81-109-B	PLUMBING AND DRAINS
	D-RF-81-100	PLUMBING STORM AND SANITARY DRAINS
	D-25581-2	FOUNDATION DRAIN PLAN
	D-1-11609-81	PLOT PLAN
	RF-81-F2-6	FOUNDATION SCHEDULE AND DETAILS
	RF-81-Y2-B	EXCAVATION PLAN
	RF-81-F7-K	FOUNDATION DETAILS
	RF-FS-21951	FOUNDATION DRAIN LINES BLDGS 883 AND 881
883	D-20612-41-A	PLOT AND DRAINAGE PLAN
	RF-14250-2	AREA DRAINAGE PLAN
	D-1-5373-83	FOUNDATION PLAN
	D-1-5162-83	FLOOR PLAN AND DETAILS
	D-28483-204	FOUNDATION SECTIONS
	D-1-5169-83	ELECTRICAL, SPRINKLERS, LIGHTING DETAILS BLDG 883
	D-25581-9	FOUNDATION DRAIN PLAN
	28483-022	SUMP DISCHARGE LINE
886	D-25925-X01	SUBSURFACE DRAINAGE CONTROL (TITLE SHEET)
	D-25925-X02	SUBSURFACE DRAINAGE CONTROL (AREA PLOT PLAN)
	D-25925-1	SUBSURFACE DRAINAGE CONTROL (UNDERGROUND DRAINS)
	D-25925-2	SUBSURFACE DRAINAGE CONTROL (PROFILE AND SECTIONS)
	D-25925-3	SUBSURFACE DRAINAGE CONTROL (GRADING AND DRAINAGE PLAN)
	D-23482-302	GRADING PLAN
	D-23482-304	DRAINAGE PLAN AND DETAILS
	D-14825-4	MISC. SECTIONS AND DETAILS
	D-14825-1	FOUNDATION PLAN AND SECTIONS
	D-17242	SUMP PUMP INSTALLATION
	D-18497-2	FOUNDATION PLAN AND DETAILS

TABLE 7-4
Industrial Area IM/IRA/DD
Foundation Drains and Foundations Drawings Cross-Reference

BUILDING	DRAWING NUMBER	COVERAGE
887	D-50026-100	DRAINAGE DITCH IMPROVEMENTS
	RF-81-F9-E	PW & SEWAGE LIFT STATION-FOUNDATION PLAN SECTIONS AND DETAILS
	RF-81-F10	PW & SEWAGE LIFT STATION-FOUNDATION PLAN SECTIONS AND DETAILS
	D-50498-401	SEWAGE LIFT PUMP STATION PIPING PLANS AND DETAILS
889	RF-BP-14286-2	FOUNDATION AND FRAMING PLANS
910	D-39365-X011	BASEMENT FLOOR PIPING PLAN DEMOLITION
991	RF-91-F1-C	FOOTING AND FOUNDATION PLAN
	RF-91-S9-C	WALL SECTIONS AND DETAILS OF STAIRS No.6
	RF-91-F2-C	COLUMN AND FOOTING SCHEDULE AND DETAILS
	D-15708-1	PLOT PLAN BLDG 991 & 998
	D-25581-10	FOUNDATION DRAIN PLAN
	1-3354-91	PLUMBING AND SERVICE PIPING-UTILITY TUNNEL
995	D-20712-51	PLOT AND GRADING
	D-38922-10	FOUNDATION PLAN
	D-20722-61	PIPING PLAN
	D-20741-30	SLUDGE DRYING BED - PLAN AND SECTIONS
	D-20741-31	CLARIFIER AND DIGESTER PLANS
	D-20741-32	SEWAGE PLANT ADDITION SECTIONS
	D-20741-33	SEWAGE PLANT ADDITION SECTIONS AND DETAILS
996/997	D-25581-12	FOUNDATION DRAIN PLAN BLDGS 996,997 & 999
	D-13812-1	FLOOR PLAN
	D-13812-3	TUNNEL PLAN - ELEVATIONS AND SECTIONS
	D-13812-5	FLOOR PLAN - SECTIONS
998	D-25581-11	FOUNDATION DRAIN PLAN
	RF-98-S2	CONCRETE TUNNEL DETAILS
	RF-98-A1	BLDG 998 PLAN AND DETAILS
999	RF-99-17701	CONCRETE PLANS AND SECTIONS
	RF-99-17702	CONCRETE SECTIONS AND DETAILS

CNNMF = CONSOLIDATED NON-NUCLEAR MANUFACTURING FACILITY
PW = PROCESS WASTE

transport because many foundation drains lead to storm drains, the sewer system, or discharge onto the ground surface.

Specific flow-path data were deduced from the engineering drawings listed in Table 7-4, information from the Surface Water Division, and November 30, 1993 and December 6, 1993 site walks. Figures A-1 through A-13 in Appendix 7.1 show the storm drains, foundation drains, building sumps, and flow paths of buildings having foundation drains in the Industrial Area. Elevations of the lowest parts of building foundations, foundation drains, and storm drains, if known, are also shown. Target foundation drains in the Industrial Area have been traced and their pathways are summarized in Table 7-5; a detailed description is given in Appendix 7.1.

7.6 CURRENT WATER PROCESS CAPABILITIES AND CAPACITIES

Existing treatment facilities and potential treatment technologies are discussed in this section.

7.6.1 Existing Treatment Facilities

Six active treatment facilities currently are capable of treating Industrial Area incidental waters: OU1, OU2, Building 374, Building 910, Building 774, and the STP. These facilities are listed and described in the following sections. Table 7-6 outlines the treatment capabilities and throughput capacity of each facility.

Other active water treatment facilities, such as the Domestic Water Treatment Plant and Pond A-4 Treatment Facility, are not discussed in this section. These facilities were determined to be inappropriate for the treatment of incidental waters because of a variety of factors. The Pond A-4 facility was excluded because of its distance from the

TABLE 7-5
Industrial Area IM/IRA/DD
Summary of Building Foundation Drains and Pathways

BUILDING	OUTFALL LOCATION	SAMPLE LOCATION	SAMPLE NUMBER	STATUS	PIPE MATERIAL	FILL MATERIAL	LOW/HIGH INVERT ELEVATION
111 (Fig. A-1)	N/V	North of NW corner of Building 111 Building sump in southern basement	FD-111-1 BS-111-2	N Y	Tile	UN	6023.1/6025.0
124 (Fig. A-2)	N/V	South of Building 664	FD-444/460	Y	CMP	UN	6027.0/6028.73
371/374 (Figs. A-3 and A-4)	Drainage ditch SE of Building 374	Metal culvert south of Building 374 North of substation road South of T771 area	FD-371-MC FD-371-3 FD-371-COMP	Y Y N	Porous Concrete, PVC	Compacted Sand	5966.1/5985.0
444 (Fig. A-5)	South of Building 664	South of Building 664	FD-444/460	Y	UN	UN	6007.0/6008.25
447 (Fig. A-5)	South of Building 664	South of Building 664	FD-444/460	Y	Tile	UN	6005.0/6018.0
Substation 517/518	N/V	Hillside north of substation road NE of 517/518 NE of 517/518	FD-371-4 FD-371-5 FD-371-6	N N N	PVC, Cast Iron	UN	5970.05/5971.5
559/561 (Fig. A-6)	STP via Building 560	Drainage to the east of 516 Manhole between 559 and 561	FD-516-1 FD-559/561	N Y	hel-cor	UN	5982.3/5985.14
707 (Fig. A-6)	750 Culvert	Vault to the north of Building 709 750 Culvert Outside NE corner of Building 707	BS-707-2 FD-707-1 BS-707-3	Y Y N	UN	Graded filter	5981.0/5982.75
771 (Fig. A-7)	N/V	Grate 50 feet SW of SW corner of 776 guardpost Building sump Building sump North of 771	FD-771-1 BS-771-2 BS-771-3 FD-771-4	Y N N N	Tile, Vitrified clay	UN	5938.0/5948.58

TABLE 7-5
Industrial Area IM/IRA/DD
Summary of Building Foundation Drains and Pathways
Page 2

BUILDING	OUTFALL LOCATION	SAMPLE LOCATION	SAMPLE NUMBER	STATUS	PIPE MATERIAL	FILL MATERIAL	LOW/HIGH INVERT ELEVATION
774 (Fig. A-7)	Northern hillside	Pond north of 774	FD-774-1	N	Tile, CMP	UN	5938.1/5952.0
779 (Fig. A-8)	North of pond 207A	Storm drain north of pond 207C	FD-779-1	Y	Open tile	UN	5974.2/5978.5
850	Southern hillside	South of Building 850	FD-850-1	N	UN	UN	UN/5991.79
881 (Fig. A-9)	Southern hillside	Concrete headwall south of Building 881	FD-881-1	Y	Steel, vitrified clay, cast iron	UN	5954.0/5980.5
883 (Fig. A-10)	West of T883 area	Manhole near SW corner	FD-883-1	Y	Steel, PVC	UN	5979.7/5986.3
865 (Fig. A-11)	Manhole on eastern side of Building 865	Manhole on eastern side of Building 865 Sump on western side of Building 865	BS-865-2 BS-865-1	Y Y	Asbestos	UN	5986.0/5988.0
886 (Fig. A-11)	Sump west of Building 875	Sump west of Building 875 Manhole east of Building 828	BS-886-1 FD-886-2	N N	CMP	UN	5975.9/5976.62
910	N/V	NE of Building 910	FD-910-1	Y	UN	UN	UN
996, 997, 999 (Fig. A-12)	N/V	UN	UN	N	Armco pipe	UN	5926.5/5946.0
991, 998 (Fig. A-13)	N/V	UN	UN	N	Armco pipe	UN	5920.0/5932.1
995	N/V	UN	UN	N	UN	UN	UN

CMP = Corrugated Metal Pipe
N = Not Currently Sampled
NE = Northeast
NW = Northwest
N/V = Not Verified
PVC = Polyvinyl Chloride
SE = Southeast
STP = Sewage Treatment Plant
SW = Southwest
UN = Unknown
Y = Currently Sampled

TABLE 7-6
Industrial Area IM/IRA/DD
Active Treatment Facilities at Rocky Flats Plant

Treatment	Description	Contaminants Treated	Capacity (gal/month)	Actual (gal/month)	References
OU1	UV/Hydrogen Peroxide and ion exchange	Uranium, hardness, metals, organic chemicals, PCBs, TDS	864,000	100,000 ave. 300,000 max.	(EG&G 1993ff), (DOE 1993)
OU2	Coagulation, precipitation, flocculation, neutralization, cross membrane filtration, granular activated carbon (GAC)	Solids, metals, organic chemicals, uranium, plutonium, americium	2,592,000 (D) 1,296,000 (A)	604,800 ave. 1,296,000 max.	(EG&G 1991j), (DOE 1993), (EG&G 1993jj)
Bldg. 374 - Waste Treatment Facility	Flash evaporation (4-effect steam heated process with spray evaporation)	Salts, inorganics, metals, uranium, americium, plutonium	1,256,584 (A)	760,805 ave. 1,268,793 max.	(ASI 1988), (EG&G 1993kk)
Bldg. 910	Vapor compression, multi-effect, multi-stage process with spray evaporation	Salts, inorganics, uranium, plutonium, americium, metals	3 units at 540,000 1,620,000 (D)		(EG&G 1993jj)
Solar Ponds*	Solar evaporation and storage for 374	Solids, metals, chemicals, uranium, plutonium, americium	93,458 (solar evaporation)	93,458 ave.	(ASI 1991d)
Bldg. 774 - Old Waste Treatment Facility	Precipitation with iron sulfate, ship to 374 for further treatment	Solids, chemical compounds, metals, high levels of uranium, plutonium, americium	Services only water from 771, 774, and bottled water		(EG&G 1993jj), (EG&G 1993ll)
Sanitary Treatment Plant (STP)	Settling, clarification, anaerobic digestion (activated sludge)	Biological, nitrates, phosphorous, chlorides, chromium, solids, organic matter, metals, <500 ppb organics	21,000,000 (D) 15,000,000 (A)	4,500,000 ave. 9,500,000 max.	(ASI 1991e), (EG&G 1993mm)

(A) = Actual capacity
(D) = Design capacity
PCBs = Polychlorinated Biphenyls
UV = Ultraviolet
TDS = Total Dissolved Solids

* It should be noted that the Solar Ponds do not accept new inputs and are scheduled for closure.

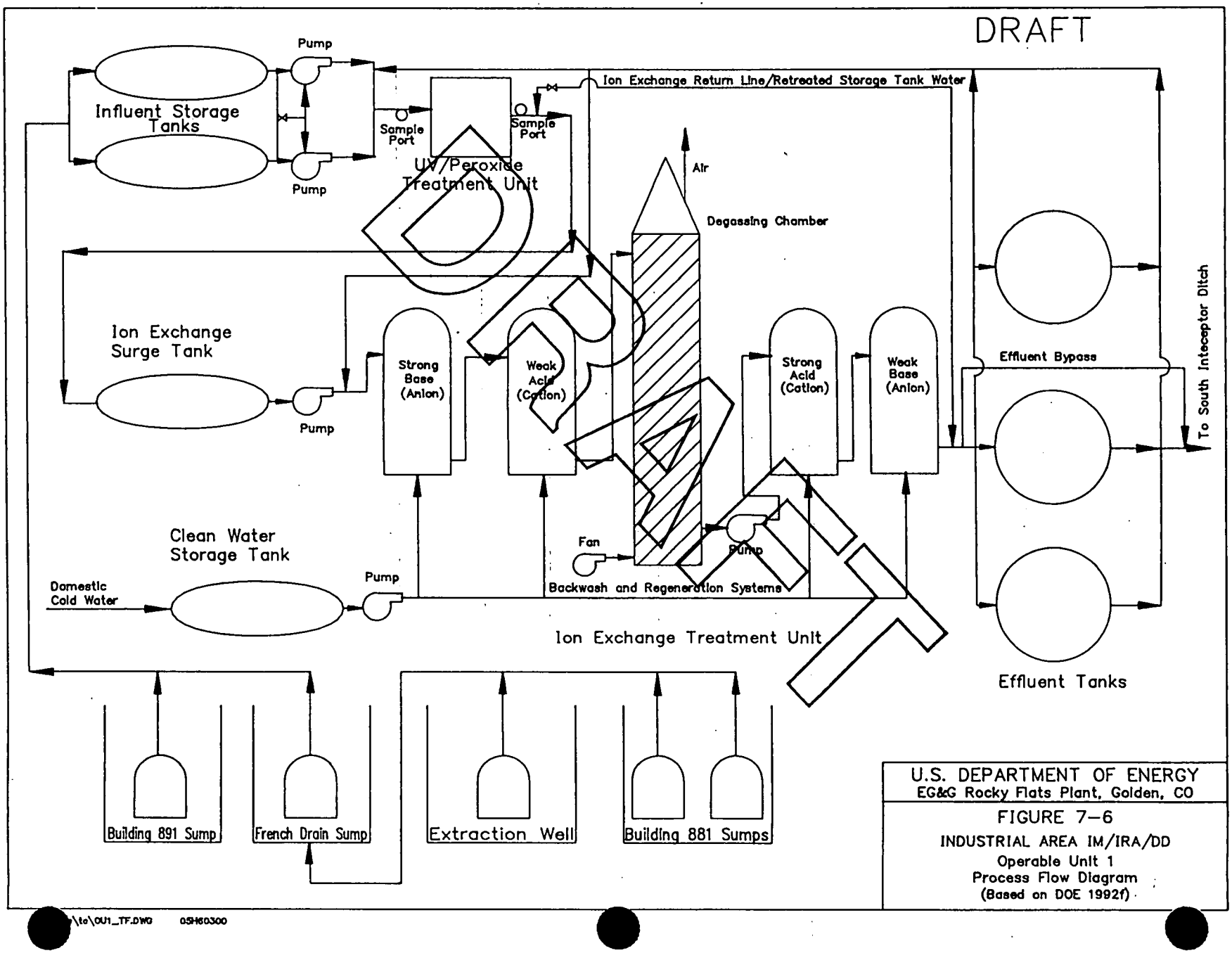
Industrial Area. The Domestic Water Treatment Plant was excluded for health reasons, i.e., treatment of contaminated waters at this facility represents unacceptable risks to the potable water system.

New facilities potentially applicable to the treatment of incidental waters are discussed in Section 7.6.2. These facilities include both existing technologies and new technologies that have the potential to replace or supplement the active treatment facilities currently available.

OU1 Treatment Facility. The OU1 treatment facility is located to the east of the Building 800 complex near the 901 contractor's yard. A french drain/recovery well system captures affected groundwater as it migrates southward from the OU. Water from the 881 Hillside foundation drains and sumps is also collected by the french drain sump (EG&G 1993bb). The treatment method used at OU1 is ultraviolet (UV)/hydrogen peroxide treatment followed by a series of ion exchange columns.

Influent water is pumped from the OU1 french drain sump/recovery well located above the southern french drain and is stored in two 15,000-gallon tanks. Figure 7-6 is a schematic diagram of the OU1 treatment system. The water is fed into a UV/hydrogen peroxide treatment unit which has a designed flow rate of 60 gpm. The UV/hydrogen peroxide process is capable of treating a wide range of volatile and semivolatile organic contaminants. Water from the UV/hydrogen peroxide process is then pumped into another 15,000-gallon storage tank and held until the ion exchange columns are available (EG&G 1993nn).

The ion exchange process consists of four ion exchange columns designed with a flow rate of 30 gpm. The first two columns remove uranium through an anion/cation exchange process. This water is routed to a degassing chamber to release any gases created in the first two ion exchange columns. After degassing, water enters the third and fourth columns where metals and total dissolved solids are removed by cation/anion



exchange resins. Ion exchange resins are typically selected for specific applications. The ability of this ion exchange process to treat for radionuclides other than uranium is unknown (EG&G 1993nn).

The water treated at OU1 is monitored continuously for pH and radionuclides during the treatment processes. Effluent water is stored in three 150,000-gallon effluent tanks until a batch can be sampled. If the effluent is determined to be "clean," it is released to the south interceptor ditch which flows to Pond C-2. If the effluent does not meet established ARARs, it is recycled through the treatment system (DOE 1993).

The OU1 treatment facility can treat up to 1,296,000 gallons per month (30 gpm) at design capacity, although expansion of the ion exchange process to 60 gpm (to match the UV/hydrogen peroxide process) would double this. Currently, the facility treats up to 300,000 gallons per month during the wet season (March, April, May) and as little as 30,000 gallons per month during the drier months. The facility was treating approximately 100,000 gallons per month during an October 1993 visit (EG&G 1993nn). Assuming the standard flow rate of 30 gpm, and normal operations at 8 hours per day, the OU1 facility has a minimum available capacity of 132,000 gallons per month. Maximum available capacity (24 hours per day operation) exceeds one million gallons per month.

Advantages of the OU1 facility for treatment of incidental waters include the large available capacity, the ability to treat most organics, and the specific ability to treat water containing uranium.

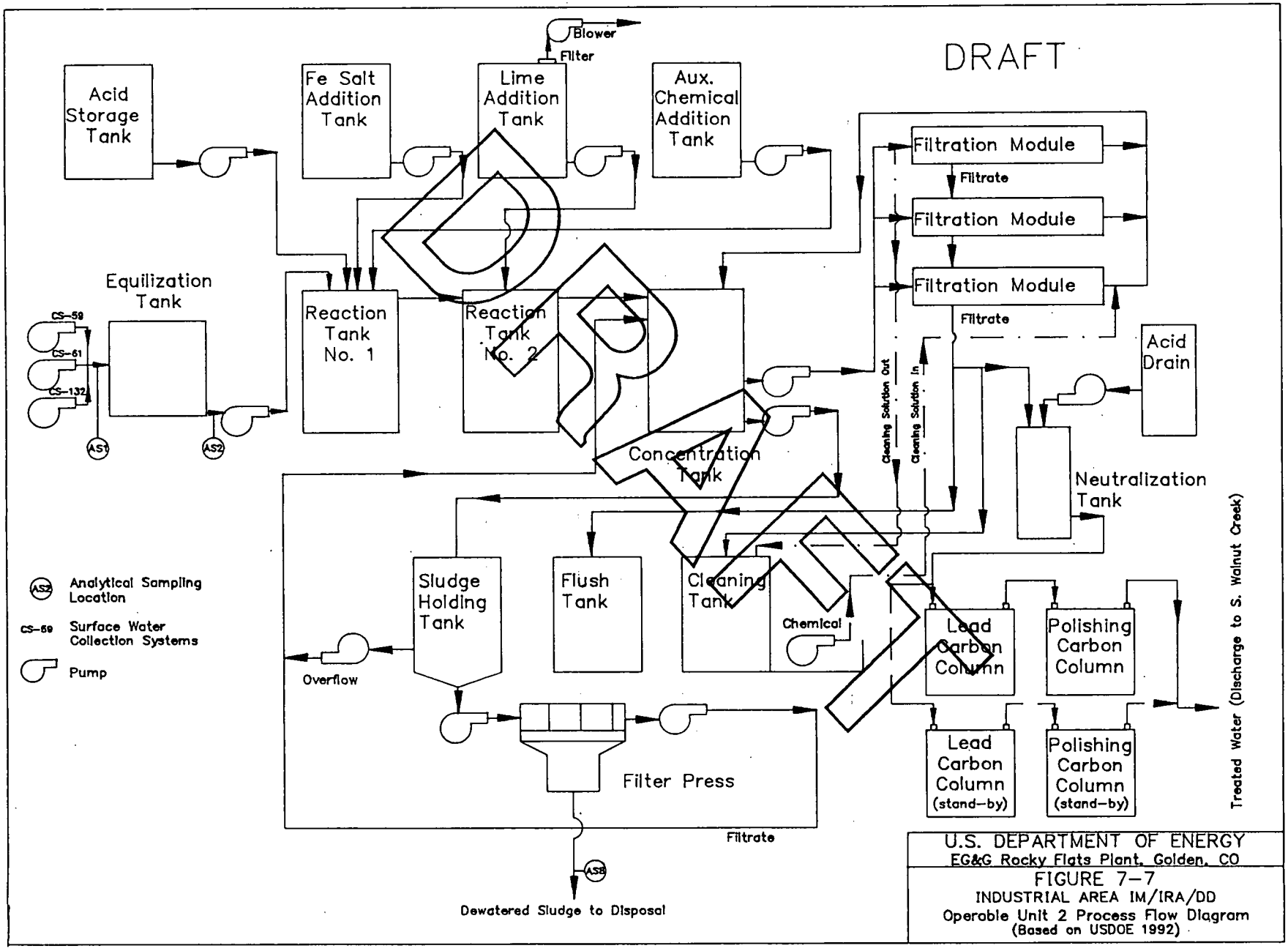
Disadvantages of the OU1 facility for treatment of incidental waters include the contaminant-specific nature of the ion exchange process, difficulties in transporting incidental waters to the facility (a tanker truck is required), and the lack of capabilities to treat water containing suspended solids. Other problems encountered with the OU1 treatment facility include difficulty in treating carbon tetrachloride, inconsistent sampling

results from the effluent storage tanks, and algae growth in the effluent tanks resulting in lowered (acidic) pHs. This may be a result of the effluent tank size or the sampling frequency. In addition, the effluent tanks have been coated with paint that has been leaching organics into the water, resulting in the detection of xylene in some samples (EG&G 1993nn).

OU2 Treatment Facility. The treatment facility at OU2 consists of ferric sulfate coagulation, high pH precipitation/co-precipitational flocculation/sedimentation followed by cross-membrane filtration, neutralization, and GAC. The OU2 facility currently treats seep water contaminated with volatile organics, heavy metals, and radionuclides. It is located in the South Walnut Creek drainage east of the plant. Figure 7-7 is a schematic diagram of the OU2 treatment facility. The treatment system is preceded by a 10,000-gallon influent tank, which feeds water to the coagulation/precipitation process where metals and radionuclides are removed. Two parallel trains of two GAC units each are installed at OU2. The parallel configuration is designed to allow for GAC changes without significant down time. GAC is a commonly used and reliable technology for treatment of a broad range of organic chemicals in water. The service life of a GAC unit in the lead position (first to receive the influent water) is approximately six weeks, after which the GAC is packaged for disposal as a hazardous waste (EG&G 1991i).

Effluent water is discharged directly into South Walnut Creek. No effluent tank allows for effluent sampling, although the final GAC unit has sampling ports. OU2 personnel have recommended that more sampling ports and effluent tanks be added to the system (EG&G 1993jj).

Both treatment processes have design capacities of 60 gpm, yielding a maximum facility capacity of up to 2,592,000 gallons per month if both GAC trains are operated simultaneously. However, the actual capacity is limited to 1,296,000 gallons per month



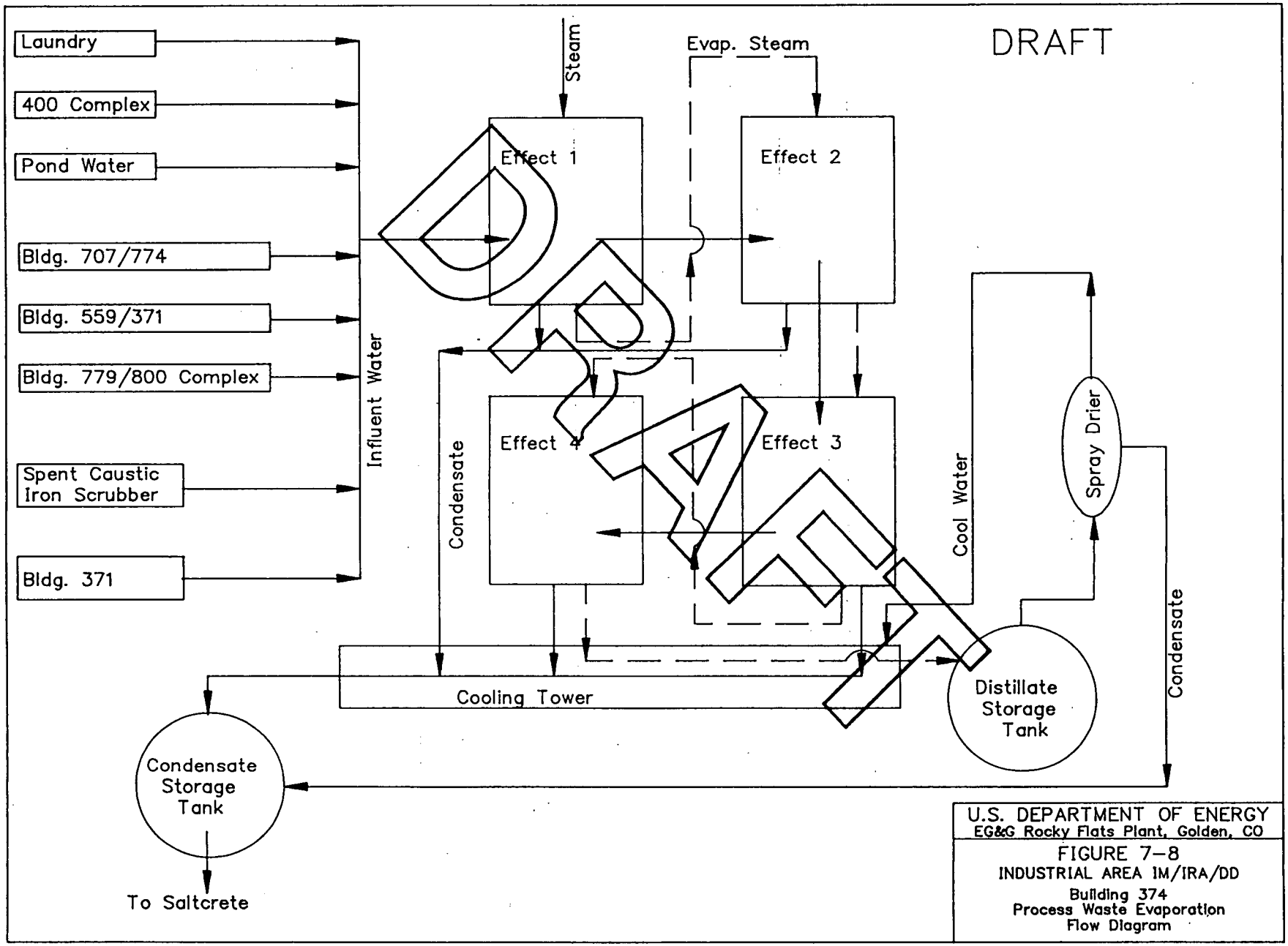
c:\rflats\to\OU2_TF.DWG 05H60300

if only one GAC train is operated at a time. The average flow rate is 604,800 gallons per month. During the wet season (March, April, May), the facility operates at or near its capacity (1,296,000 gallons per month) (DOE 1993). The average available capacity for the treatment of incidental waters is approximately 690,000 gallons per month (16 gpm) except during March, April, and May. The OU2 treatment facility currently is not used to treat incidental waters.

The advantages of the OU2 treatment facility in treating incidental waters are its ability to handle waters containing high suspended solids and its ability to treat a broad range of organic constituents. Disadvantages include the significant volume of waste materials generated, the lack of capacity during the wettest periods (March, April, and May), and the difficulty in transporting incidental waters to the facility location (a tanker truck is required). Because of low influent concentrations, the coagulation/precipitation process has shown only limited success with metal and radionuclide removal.

Building 374 - Process Waste Treatment Facility. Building 374 is located in the northwestern portion of the Protected Area on the eastern side of Building 371. This facility treats dilute process waste water containing metals, radionuclides, and inorganics and produces distilled water for reuse and a concentrated salt solution (saltcrete), which is stabilized for disposal. Figure 7-8 is a schematic diagram of the 374 waste treatment processes.

All process waste waters from the plant process waste collection system are routed to Building 374, where they are neutralized, stored, and characterized before treatment. The 374 treatment facility is designed to treat water containing metals, radionuclides, and de-saltable aqueous wastes. Building 374 has no capabilities for handling organic wastes (EG&G 1992q). Waters containing high concentrations of metals or radionuclides are diverted to a precipitation process, which uses hydroxide and/or sulfate precipitation processes to remove most metals and radionuclides. This system was included as part of the operations to be permitted in the RCRA Part B Permit Applications made for low-



U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 7-8
INDUSTRIAL AREA 1M/IRA/DD
Building 374
Process Waste Evaporation
Flow Diagram

G:\RFLATS\TC\374_TF.DWG 05H60300

level mixed wastes, transuranic waste, and mixed residues. Effluent from this process is returned to the evaporation process storage tanks for further treatment. Sludge from the precipitation process is immobilized with cement and disposed of as radioactive waste. Dilute process waste waters are sent directly to the evaporation process. Excess (dilute) waste waters are transferred to the 231 Tank for storage pending treatment. Environmental waters (i.e., incidental waters, purge waters) that are collected from the plant site in tanker trucks are pumped directly into the 231 Tank (EG&G 1992o).

The Building 374 evaporation process is a flash evaporation using a four-stage steam-heated process with spray evaporation. Water is pumped into the first stage (effect) that heats and circulates the water until it evaporates. The water and steam flow through the four stages under decreasing pressure until the water in the fourth stage can be condensed and contained in an effluent condensate tank for sampling. If the sampling indicates the condensate meets applicable water quality standards, it is recycled for use in the Building 374 cooling tower and steam plant. The concentrated liquid from each stage is collected and stored in the concentrate holding tank until it can be saltcreted and stored (EG&G 1992o). Saltcreting is a process by which a waste is concentrated to 35 percent solids and mixed with portland cement for solidification and stabilization.

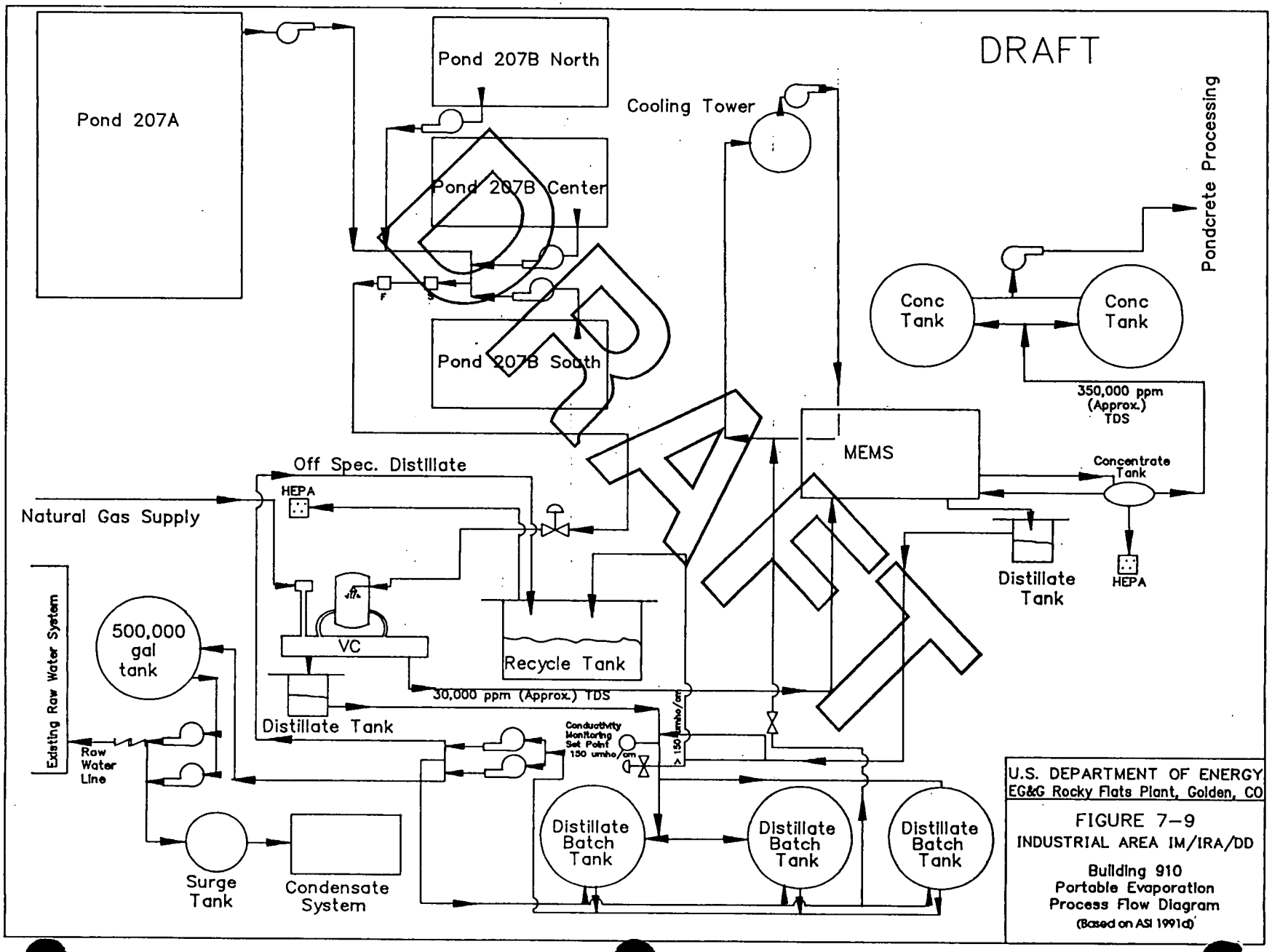
The 374 evaporation process can treat up to 1,256,584 gallons per month and historically (during full RFP production) operated at or near capacity. Currently, the facility treats an average of 760,805 gallons per month with approximately 90 percent originating from laundry waste water effluents. This average treatment volume is expected to rise to approximately 900,000 gallons per month during full D&D. Available capacity for treatment of incidental waters at Building 374 is expected to remain in excess of 300,000 gallons per month for the foreseeable future. Occasionally, the facility receives more water than capacity and the excess water is stored in the SEPs until it can be treated (EG&G 1993kk). Building 374, via the 231 Tank, currently treats the majority of incidental waters at RFP.

Advantages of the 374 treatment facility for the treatment of incidental waters include a large storage capacity at the 231 Tank, a consistent, available capacity for treatment, and an ability to accept virtually any mixture of constituents (other than organics) in a broad range of expected environmental concentrations.

Disadvantages include the inability to treat for organic contaminants and the need to use tanker trucks to transfer incidental waters to the facility. There are set limits on the amount of chlorides and radionuclides that can be treated at the facility, but these concentrations are not expected to be commonly reached in incidental waters (EG&G 1993kk).

Building 910 - Treatment Facility. Building 910 is located to the south of the 207B series solar ponds. Building 910 houses the facilities that primarily treat water from the SEPs and water contained in the modular storage tanks that collect water from the northern Interceptor Trench of OU4 as a part of the IM/IRA for OU4, the solar ponds (EG&G 1993ii). The 910 facility consists of three identical units, each consisting of a vapor compression (VC) unit and a multiple-effect multiple-stage (MEMS) evaporator, and are designed to treat aqueous waste streams containing metals, radionuclides, and nitrates. Currently, Building 910 is associated with evaporators and not the reverse osmosis (RO) plant that was present in the 1970s and 1980s. Figure 7-9 details the Building 910 evaporator process for one evaporation unit.

Each VC/MEMS unit receives influent through the manifold station. The water is filtered and then passed through the preheater before entering the VC unit. The concentrate is fed to the MEMS for further concentration. The distillate from the VC/MEMS is collected into small (7,000-gallon) surge tanks and then passed through an in-line conductivity monitor. If the conductivity is less than 150 μmhos/cm, the water is transferred to a 500,000-gallon effluent batch tank, sampled, and then injected into the



Raw Water System for use by the plant cooling towers. If the conductivity is greater than 150 micromhos per centimeter(μmhos/cm), the water is sent back to the VC unit for reprocessing. Concentrate from the VC/MEMS units is collected, sampled for waste characterization, and sent to Building 374 for saltcreting (EG&G 1993ii).

Each VC/MEMS system has a design capacity of 540,000 gallons per month for a total of 1,620,000 gallons per month (EG&G 1993ii). Because of the limited operational history of these units and the large volume of water at OU4 requiring treatment, the available capacity of these units for treatment of incidental water is unknown at this time.

Similar to Building 374, the VC/MEMS units are unable to treat organic compounds and also have limitations on chloride and radionuclide ($<$13,000 pCi/L) concentrations that can be treated (EG&G 1993kk). It is believed that some of these limitations could be eliminated with the addition of a GAC or hydrogen peroxide unit (EG&G 1993jj). Building 910 is not currently used to treat incidental waters.

Building 774 - Treatment Facility. Building 774 is the old process waste treatment facility. It is located in the northern part of the Protected Area to the east of Building 771. The facility is very old and currently functions as a pretreatment facility for process wastewater collected in Buildings 771 and 774, and any plant water containing high radionuclide concentrations. In the past, Building 774 had the capability of treating organics through the "jelly plant" and the OASIS system, but currently these systems are inoperable (EG&G 1993ll).

A precipitation process similar to that described for Building 374 is conducted; liquid effluents are sent to Building 374 for further treatment. The concentrated wastes are saltcreted and stored (EG&G 1987). Building 774 could pretreat incidental waters having high concentrations of radionuclides. However, incidental waters having high radionuclide concentrations are unlikely to be present based on historical information.

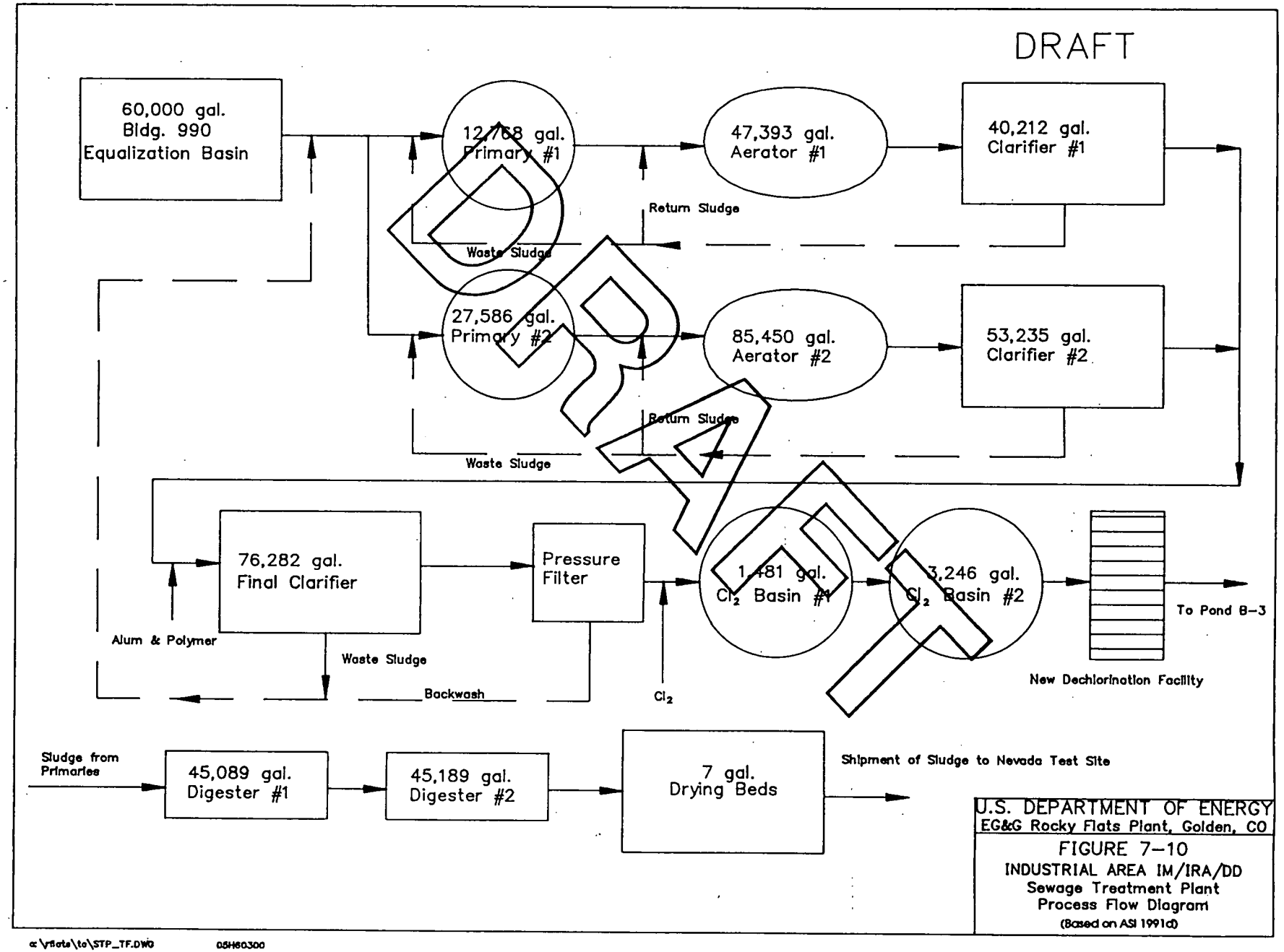
Solar Ponds. The SEPs are located to the east of Buildings 774 and 779. They are currently scheduled for closure, and new inputs to the ponds are prohibited. They contain water that will be treated by either the evaporators in Building 374 or 910 (EG&G 1993ii).

Although not a designed water treatment facility, the SEPs were a part of the treatment facilities on the RFP site. The SEPs were designed to hold water and allow suspended solids to settle to the bottom to eventually form pondcrete. The ponds are exposed directly to the atmosphere, and solar evaporation occurs at an average of about 93,458 gallons per month (ASI 1991d). The SEPs currently do not receive incidental waters.

Sewage Treatment Plant. The STP is located in Building 995 outside the Protected Area to the east. The STP is designed to treat normal wastewater from RFP, but does currently receive some incidental waters from the foundation drains of Building 559, the 900 area, and possibly other buildings on plant site.

Influent to the STP flows through two 60,000-gallon equalization basins (Building 990) that can be separately isolated and held in the event of a spill or contamination event within the sewer system. The STP is a flow-equalized two-train continuous flow activated sludge system followed by polymer/alum enhanced postsecondary clarification, filtration, chlorination, and dechlorination. Sludge is dried to 43 percent solids before being transported offsite for disposal. Sludge bed leachate is collected and retreated. Effluent water is sampled and released to Pond B-3 when it meets applicable water quality standards as defined by the current NPDES discharge permit (EG&G 1992a). Figure 7-10 schematically shows the layout of the STP.

The facility can treat dilute (<2.5 milligrams per liter [mg/L]) concentrations of organic chemicals and can remove some metals and radionuclides at low concentrations. There is some concern for the problems that would result from the introduction of toxic or



U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO

FIGURE 7-10
INDUSTRIAL AREA IM/IRA/DD
Sewage Treatment Plant
Process Flow Diagram
(Based on ASI 1991d)

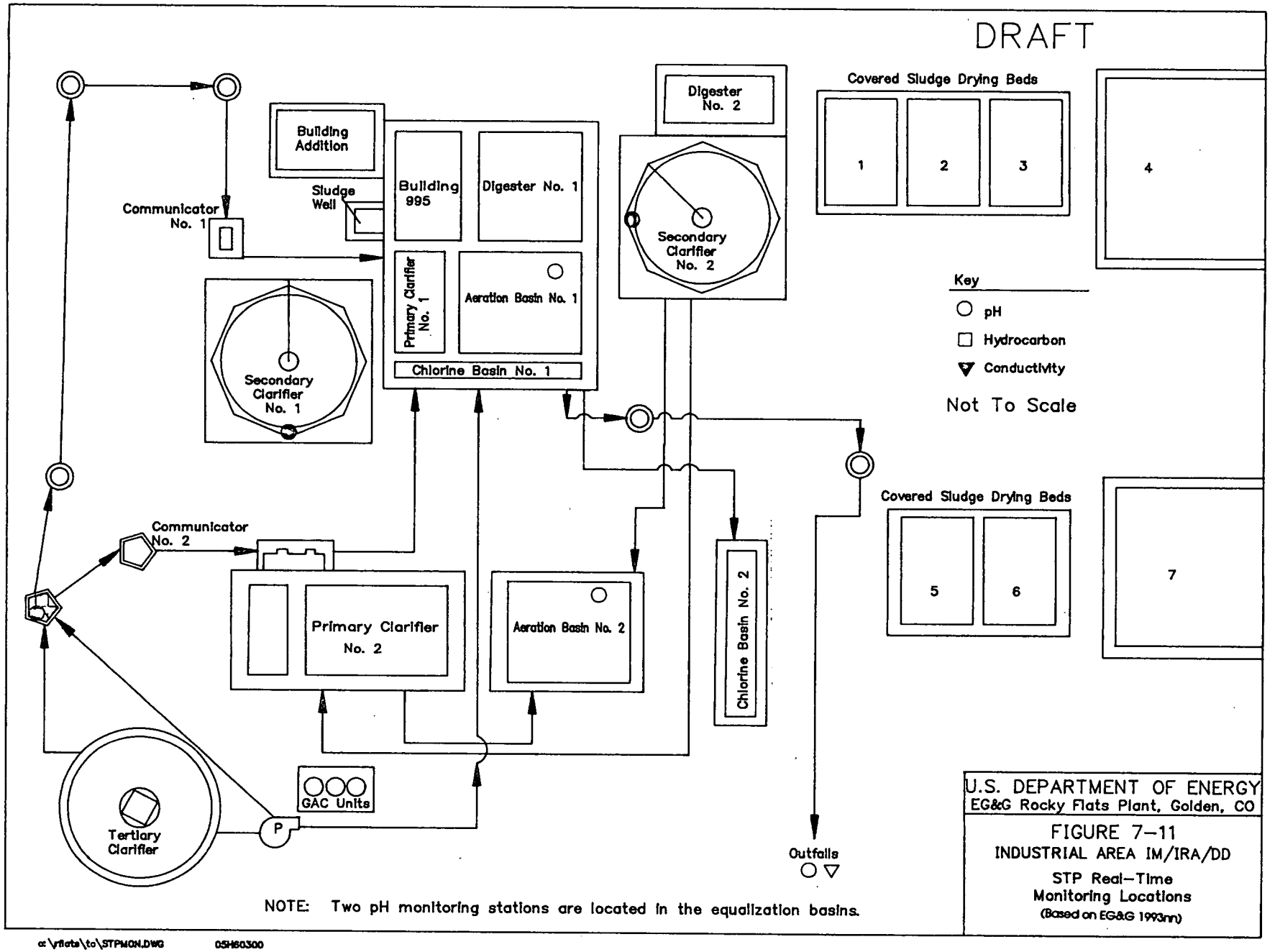
c:\rfsata\ta\STP_TF.DWG 05H60300

radioactive contaminants to the digesters, which could potentially cause system upsets or sludge disposition problems (EG&G 1993mm). Discharge from the Building 559/561 foundation drain is currently being treated by the STP. This water has low levels of carbon tetrachloride, which the STP is treating at concentrations of less than 500 parts per billion (ppb) (EG&G 1993mm).

The design capacity of the STP is 21,000,000 gallons per month, but the actual capacity is limited to 15,000,000 gallons per month by operational considerations. The facility receives an average of 4,500,000 gallons per month, with the wet months being closer to 9,500,000 gallons per month (EG&G 1993mm). Substantial available capacity exists at the STP for the treatment of incidental waters. With the addition of an influent limitation of approximately 2 to 2.5 mg/L TTOs (an expected addition to the new NPDES permit), most incidental waters containing environmental concentrations of organics can be sent to the STP without additional pretreatment.

STP personnel indicated that eight real-time pH monitoring stations are associated with the STP. Two are located in the basins, one is located at the final outfall, and the other five are located within Building 995. In addition, there are two real-time conductivity monitors and one real-time hydrocarbon monitor. These locations are shown in Figure 7-11. Specific real-time monitoring includes radionuclides and chlorine (EG&G 1993mm). Wackenhut operates the radionuclide monitor; data are not available. The specifications and existence of the gamma detectors on the feed lines to the STP are not classified, but it is not known where this information can be found (EG&G 1993oo).

Advantages of the STP for the treatment of incidental waters include the large available capacity, the ability to handle high suspended solids, the ability to treat low levels of organics, and the ease of transport (i.e., waters can be discharged into the nearest sewer manhole).


DRAFT
Building Addition
Building 995
Digester No. 1
Digester No. 2
Sludge Well
Communicator No. 1
Primary Clarifier No. 1
Aeration Basin No. 1
Chlorine Basin No. 1
Secondary Clarifier No. 1
Secondary Clarifier No. 2
Covered Sludge Drying Beds
1
2
3
4
Key
pH
Hydrocarbon
Conductivity
Not To Scale
Communicator No. 2
Primary Clarifier No. 2
Aeration Basin No. 2
Chlorine Basin No. 2
Covered Sludge Drying Beds
5
6
7
GAC Units
P
Tertiary Clarifier
Outfalls
NOTE: Two pH monitoring stations are located in the equalization basins.
U.S. DEPARTMENT OF ENERGY
EG&G Rocky Flats Plant, Golden, CO
FIGURE 7-11
INDUSTRIAL AREA IM/IRA/DD
STP Real-Time Monitoring Locations
(Based on EG&G 1993nn)
c:\rfets\to\STPMON.DWG 05H60300

Disadvantages include potential upsets to the activated sludge organisms if metal or organic concentrations are too high, and potential waste disposal problems for metal or radionuclide-laden sludges. If contaminated waters are treated at the STP, hazardous waste will be generated in the sludges that will require appropriate disposition.

Table 7-7 outlines the current methods for disposing of the various wastes that are generated from the treatment facilities at Rocky Flats.

7.6.2 Potential Treatment Technologies

Because the locations and characteristics of incidental waters can be highly variable, treatment of incidental waters originating within the Industrial Area requires that equipment or facilities be either portable or easily added to an existing water treatment facility. Table 7-8 shows technologies evaluated as potentially applicable to Industrial Area incidental waters. Some of the technologies have undergone pilot testing, others are still in the R&D stage and have not been field-tested, and still others use available proven technologies. Potential technologies discussed below include a variety of physical and thermal processes. Chemical and biological processes, such as redox, chemical precipitation, or trickling filter technologies require a level of process control evaluated as unachievable for the highly variable nature of incidental waters and were not considered further.

Portable Colloid Polishing Filter Method (CPFM). CPFM uses a mini-clarifier, bag filter, colloid filter, and chemical and mechanical mechanisms to treat water for low-level radionuclides, solids, and metals. This technology was successfully pilot tested at 5 gpm (216,000 gallons per month) as part of site-wide treatability studies (EPA 1993b). This technology is applicable to waste streams with low influent concentrations with a removal efficiency of approximately 90 to 99.6 percent.

TABLE 7-7
Industrial Area IM/IRA/DD
Current Disposition of Water and Waste
at Active Treatment Facilities Rocky Flats Plant

Treatment Facility	Water Disposition	Waste Disposition
OU1 - UV/Peroxide	Feeds into effluent tanks to be sampled, then released to the South Interceptor Ditch system or retreated if sample levels are unacceptable.	Ion exchange resins are purged periodically and stored until they can be sent to the Nevada Test Site.
OU2 - GAC unit	Discharges directly into South Walnut Creek.	Spent GAC and filter bags are stored onsite until they can be sent to the Nevada Test Site.
374 - Process Waste	Collected into effluent tanks to be sampled, then recycled to the 374 cooling tower and steam plant.	Wet sludge is saltcreted and stored onsite.
774 - Old Process Waste	Water is transferred to 374 for further treatment.	Wet sludge is saltcreted and stored onsite.
910 - Portable Evaporators	Collected into effluent tanks to be sampled, then injected into the raw water system for use by the plant site cooling towers.	Wet sludge is saltcreted and stored onsite.
Solar Ponds	Water is evaporated directly into the air.	Sludge and sediment are pondcreted and stored onsite.
STP	Collected into effluent tanks to be sampled, then released to the B series ponds.	Dried sludge is packaged and shipped to the Nevada Test Site.

Notes:
GAC = granular activated carbon
STP = sewage treatment plant
UV = ultraviolet

References: *RFP Mission Transition Program Management Plan*, Appendix A-3 (EG&G 1992a) and Operational Safety Analysis reports (EG&G 1992o; EG&G 1993ii)

TABLE 7-8
Industrial Area IM/IRA/DD
Potential Treatment Technologies for Incidental Waters

Treatment Technology	Description	Contaminants Treated	Portable Unit Capacity Range	Availability Status	References
Membrane Separation (Ultrafiltration, Hyperfiltration, Reverse Osmosis)	Filtration of ionic and molecular species by forcing water molecules through low permeability membranes.	Salts, dissolved organics ($<.45\mu$), rads, metals	0-6 gpm	Commercially available	Keddy 1989
Portable Colloid Polishing Filter Method (CPFM)	Miniclarifier, bag filter, colloid filter, chemical/mechanical mechanisms to remove colloidal particles	Low level rads, solids, metals	5 gpm system tested	Pilot testing only	DOE 1992f, EPA 1993b
Solar Catalytic Detoxification	Hollow tube kynar panel with titanium oxide catalyst exposed to UV radiation	Organics	.5-1. gpm system tested	Bench-scale testing only	SAIC 1993
Ion Exchange (IE)	Gravity or pressure fed tanks with resins that remove contaminants by ion replacement	Metals, rads, inorganics	0-10 gpm	Commercially available	DOE 1993, Keddy 1989
Granular Activated Carbon (GAC)	Gravity or pressure fed tanks containing GAC remove contaminants by adsorption	Organics	10-200 gpm	Commercially available	DOE 1993

Table 7-8 (cont'd.)

Treatment Technology	Description	Contaminants Treated	Portable Unit Capacity Range	Availability Status	References
Particulate Filtration	Media (sand) or sieve (fabric) filters remove contaminants by retention of particles	Suspended solids (>.5μ), rads metals adsorbed on particles	20-100 gpm	Commercially available	DOE 1992f, Moritz et al. 1992
Enzyme Treatment (Biological)	N/A	Soluble organics in dilute aqueous waste streams; requires stable influent concentrations	N/A	N/A	EPA 1989a
Trickling Filter (Biological)	N/A	Soluble organics in dilute aqueous waste streams; sludge has contaminants requiring further treatment	N/A	N/A	EPA 1989a
Chlorinolysis (Chemical)	N/A	Concentrated liquid chlorinated organic waste streams with low concentrations of S and O_2; no tars, benzene, aromatics	N/A	N/A	EPA 1989a
Oxidation - Chlorination, Ozonation, H_2O_2, $KMnO_4$, Chlorine Dioxide, Hypochlorites (Chemical)	Water is pumped into a reactor vessel, mixed with oxidizer, exposed to UV radiation, produces CO_2, H_2O, and innocuous salts	Dilute aqueous wastes with organic/inorganic compounds; requires controlled reactions; sludges and liquids only	N/A	Bench-scale testing only	EPA 1989a, Keddy 1989

Table 7-8 (cont'd.)

Treatment Technology	Description	Contaminants Treated	Portable Unit Capacity Range	Availability Status	References
Precipitation (Chemical)	Compounds are reacted with a suitable material to form insoluble salts	Aqueous organic/inorganic waste with metals; requires optimum pH for specific mix of metals present, possible cross reactivity, sludge requires further treatment	N/A	N/A	EPA 1989a
Reduction - SO_2, Sodium Horohydride Sulfate Salts, Ruthenium Tetrozide (Chemical)	N/A	Dilute aqueous waste streams with inorganic compounds, especially metals; liquid inorganic waste only	N/A	N/A	EPA 1989a
Gravity Separation (Physical)	N/A	Liquid waste with settable suspended solids, oils, and grease, no heavy slurries, effluent requires more treatment	N/A	N/A	EPA 1989a
Metal Binding (Physical)	N/A	Metal-contaminated aqueous waste streams, leachate, or groundwater; metal concentrations 500-1,000 ppm	N/A	N/A	EPA 1989a

Table 7-8 (cont'd.)

Treatment Technology	Description	Contaminants Treated	Portable Unit Capacity Range	Availability Status	References
Pure Oxygen Burner (Thermal)	N/A	Liquid wastes which require high temps. for destruction or have low heating values; requires special engineering	N/A	N/A	EPA 1989a
Ultrox - UV Radiation/Oxidation (Chemical)	Skid-mounted UV oxidation reactor (see Oxidation above)	Dissolved organics, chlorinated HCs, and aromatics; pretreatment needed for high Mn, oil, grease and suspended solids	~25 gpm	Bench scale testing only	Keddy 1989
Supercritical Water Oxidation (Thermal)	Waste slurried to provide .7-10% organics, heated, O_2 pressurized and mixed to oxidize contaminants	Aqueous organic solution/slurry or mixed organic/inorganic waste	N/A	Developing	EPA 1989a, Keddy 1989

gpm = gallons per minute
N/A = not available
UV = ultraviolet

Granular Activated Carbon. GAC is a proven, commercially available technology for the treatment of a broad range of organic contaminants. The compounds are removed by adsorption to the activated carbon molecules. Treatment efficiency is correlated to retention time (i.e., contact time) within the GAC tank, which is a function of the flow rate and tank size. Removal efficiencies of 99 percent have been demonstrated with carbon tetrachloride, TCE, and TCA as well as pesticides, chloroform, and trihalomethane (THM). Portable GAC units are limited by the size and load restrictions of the vehicle transporting the GAC units. GAC is generally not sensitive to changes in concentrations (as long as contact time is maintained) and can be started up and shut down rapidly.

Solar Catalytic Detoxification. Solar catalytic detoxification uses UV radiation in the presence of a catalyst to destroy organic contaminants by changing their chemical structure to simpler, less toxic compounds. A proprietary solar-powered photoreactor is being developed and tested by SAIC for the National Renewable Energy Laboratory photoreactor development program. The SAIC photoreactor is a portable, inexpensive, and easy to manufacture system containing no moving parts, and consists of flexible panels with circular flow passages containing a titanium oxide catalyst. This system has demonstrated the ability to reduce 1 part per million (ppm) TCE to less than 5 ppb (99.5 percent destruction) in a recirculating system exposed to the equivalent of one sun of UV radiation (SAIC 1993). Research on this technology is continuing but is currently not commercially available.

Ion Exchange. Ion exchange technology is a proven and commercially available treatment technology for dissolved metals, some inorganics, and some radionuclides, in particular, radium and uranium. Undesirable ions are replaced with other ions, typically H^+, Na^+, Cl^- or HCO_3^-. Undesirable ions remain attached to the ion exchange resin. Ion exchange systems are easy to operate, can handle a fluctuating feed rate, and can be built on a small (i.e., portable) scale. However, ion exchange systems generally target

specific contaminants, and yield a concentrated waste stream requiring further handling and disposal.

Membrane Separation Technologies. Membrane separation technologies include ultrafiltration (UF), hyperfiltration (HF), and RO. All of these technologies use pressure and semipermeable membrane to separate non-ionic materials from a waste stream based on molecular weight. These membrane technologies are particularly effective for the removal of dissolved solids, large organic molecules, and complex metals. HF removes species having molecular weights between 100 and 500. UF removes species having molecular weights greater than 500. RO is a form of HF capable of removing ionic as well as non-ionic species. Each of these technologies require relatively sediment-free influent in order to prevent fouling and plugging of membranes. Generally, membrane separation technologies are not applicable to raw waters without initial pretreatment for sediment removal, and require a high level of process control to ensure effective operation.

Particulate Filtration. Particulate filtration technologies are distinguishable from membrane separation technologies by virtue of the size range of particle being removed. Particle filtration technologies are limited to the suspended range (i.e., >0.45 micron) of solids and have no effect on aqueous organic contaminants. Filters are available for a wide range of applications and are generally of two types. Media filters use granular media such as sand or coal to trap suspended particles as water percolates through them. Media filters are generally used for wastewaters containing coarse suspended solids at greater than 30 mg/L concentrations. Strainer type filters use a mesh or fabric rated for a certain size particle such as 1, 10, or 30-micron, and are generally used for dilute waste streams of less than 30 mg/L TSS. Microstrainers having a filtration rating of 20 to 70 microns have been tested on surface waters at RFP, but have proven ineffective on dilute waters where TSS was below 20 mg/L. Bag filters have also been tested and shown 99 percent removal efficiency at both 10-micron and 30-micron size ranges, and

greater than 94 percent efficiency at 1-micron and 5-micron sizes for influent water at less than 20 mg/L TSS (Moritz and Olthos 1992).

7.7 DATA GAPS, DISPOSITION, AND PROCESS NEEDS

Data gaps, disposition, and process needs for the RFP IM/IRA are discussed in this section.

7.7.1 Data Gaps

Several data gaps were identified during the study of incidental waters in the Industrial Area. It is important to fully understand the incidental water and foundation water system at RFP to make accurate recommendations. These informational gaps are discussed below.

The current procedure covering incidental waters, the CDIW, does not cover foundation drain or building sump waters and generally does not require in-depth sampling and analysis for metals, specific radionuclides, or organics. Therefore, the presence of specific potential chemicals of concern is unknown. The foundation drain monitoring program established by the Surface Water Division has generated a great quantity of data; however, this information has yet to be analyzed and incorporated into the current management program. The consolidation of existing foundation drain, building sump, and other incidental water data could be used to assist in locating and characterizing contamination within the Industrial Area during D&D.

A complete understanding and characterization of incidental waters including foundation drain waters does not currently exist. Major data gaps include the volume of flow at specific foundation drain locations, a lack of information on specific contaminants, and poor sampling coverage of foundation drain locations. It appears that some foundation

drains are being sampled in inappropriate locations, and other key sampling locations are not sampled at all. Discussions of some of these cases follow:

- Building 111: The outfall appears to be to a drainage ditch to the north of Building 111, but the sampling location is a sump that is located in the southern area of the building. It appears from utility and engineering drawings that this sump is not connected with the foundation drains but may be connected with the floor drains in Building 111. The outfall to the ditch is not currently being sampled.

- Building 371/374: Six outfalls are indicated on the engineering drawings and by the building personnel. Of these six, only two outfall locations are visible, and only one is being sampled. FD-371-2 has been rerouted, according to Surface Water Division personnel, to join FD-371-3 (EG&G 1993pp), but visible seepage was found during site walks on November 30 and December 6, 1993. This seepage should also be sampled, and other outfalls need to be located and sampled.

- Building 707: Currently, the sample location that is supposed to correspond with the foundation drains in Building 707 is a vault located to the north of Building 709. According to the engineering and utility drawings, this vault has no interaction with the foundation drains from Building 707. A more reasonable sampling location might be at the southwest corner of Building 707 where the foundation drains join the storm drains that run to the east along the southern wall of the building. A concrete clean-out port is at this location that could possibly make a good sampling port; however, it was not possible to verify this.

- Building 771: The current sampling location for the foundation drains in Building 771 is a metal grate located near the northwest corner of the building. This grate appears to be connected with one of the five foundation drain exit points. This

grate is covered with sediment, and appears to no longer be a suitable sampling location. Four of the five foundation drains lead to Manhole #3 located near the northwestern corner of Building 771. This manhole is a potential sampling port for future sampling of Building 771 foundation drains. The destination of the effluent from Manhole #3 is unknown, and one of the foundation drain outfalls was not located during site walks.

- Building 991: According to Surface Water Division personnel, the foundation drains for Building 991 have all been rerouted to a sump in the basement of the building that is currently being sampled as part of the foundation drain sampling program (EG&G 1993pp). According to the utility drawings as well as the building manager (EG&G 1993qq), the foundation drains join the sanitary sewer system and run northeast from the northeast corner of the building. Currently, sampling of these foundation waters does not occur in the sanitary sewer lines. A series of manholes near where the foundation drains are believed to join the sewer lines could be potential sampling ports. It is recommended that these manholes be evaluated for a new 991 foundation drain sampling location.

There is some uncertainty in where foundation drains actually originate and daylight. This uncertainty is particularly a problem with Buildings 371, 771, 865, and 991.

The ultimate destination of the water from some of the building sumps is unknown. Some, but not all, of the building sumps are routed to the process waste system. It is necessary to know these other destinations to fully understand the sump collection system, but this information is not available.

In some areas, the foundation drain sampling locations suddenly went dry. It is necessary to understand what happened in the areas with "dry" sample locations to change the flow. If construction in the area has rerouted these drains or capped them, documentation on where, when, and how this was performed needs to be made available.

If the pipes have broken or collapsed, this needs to be verified also. This information may be incorporated as part of the Industrial Area RI.

Information concerning the new NPDES permit for RFP and how this permit relates to incidental waters and the Industrial Area in general is an additional data gap. This issue is discussed in the following section.

7.7.2 Disposition

Complicating the potential disposition of incidental waters from the Industrial Area (including foundation drain waters) is an ongoing effort to modify the current RFP NPDES discharge permit for the STP. This permit revision is relevant to the Industrial Area IM/IRA/DD because certain provisions of the permit are expected to address the monitoring and disposition of water discharging from foundation drains at various buildings within the Industrial Area.

Under discussion as an addition to the discharge permit covering the STP is a requirement to monitor foundation drain effluents for TTO. A numerical standard for TTOs would be established (a value of 2.1 mg/L is currently being discussed by the EPA) below which foundation drain discharges to the sanitary sewer system (and STP) would be specifically allowed without additional pretreatment. Waters testing above the standard would be transferred to a storage facility and treated by an appropriate method.

This TTO standard is based on EPA literature that recognizes that activated sludge processes similar to those at the RFP STP are capable of treating low levels of organic chemical contaminants. Uncontaminated foundation drain waters, as defined by the NPDES permit, would continue to be discharged to surface water. This potential new permit provision is a direct result of the detection of carbon tetrachloride in Building 559 and is seen as a way to clarify the level of organics contamination in incidental waters that is allowable to be input to the STP.

As mentioned previously, incidental waters other than foundation drain waters (such as groundwater encountered and pumped out during excavation activities and water within secondary containments) are currently covered by existing approved procedures. The requirements for incidental waters disposition can be summarized as capture, hold, analyze, and dispose of, as appropriate. The analytical suite for incidental waters includes pH, conductivity, nitrate, gross alpha, and gross beta only. Other parameters may be monitored depending on location and the presence of known or suspected contaminants. Disposition of the incidental waters (after receipt of analytical results) can be to the environment, to the sanitary sewer (and STP), or to Building 374 for treatment. Addition of the TTO standard to the incidental waters procedure would be consistent with the previously discussed NPDES permit provision and would allow discharge of some incidental waters to the sanitary sewer, which currently would require special treatment.

Two other issues are of note with respect to the monitoring and disposition of incidental waters particularly with respect to the conduct of D&D activities for buildings within the Industrial Area. Both issues concern Building 374, the primary process wastewater treatment facility at Rocky Flats. The first issue concerns the continued reuse of product water from Building 374, and the second issue deals with a potential Waste Water Treatment Unit Exclusion (WWTUE) for the building under existing hazardous waste regulations. With a WWTUE in place, and continued reuse of product water, most incidental waters generated within buildings as a result of D&D efforts can be handled as nonroutine wastewater discharges rather than as a classified hazardous waste stream.

Building 374 collects and treats process wastewaters, and discharges (recycles) product water to the 374 cooling tower and the RFP steam plant, as a "commercial substitute" for raw water. The presence of di(2-ethylhexyl)phthalates, a common plasticizer, in RFP laundry wastewater, which is influent to the Building 374 treatment facility, affects this commercial substitution classification of the product water. This compound results from the washing of plastic-soled booties, is not classified as a hazardous waste, but is not treatable at Building 374. To claim a commercial substitute designation for the product

water, the water must be substantially equivalent to a raw water and/or meet Safe Drinking Water Act Maximum Contaminant Levels. Incidental waters generated by D&D activities, as well as other environmental incidental waters, must be monitored closely to prevent a similar situation from occurring. Without the "commercial substitution" of Building 374 product water for raw water, the volume of water to be handled under RCRA and/or the Industrial Area IM/IRA/DD increases by approximately 13 million gallons.

The second issue pertaining to disposition of Industrial Area incidental waters concerns a WWTUE for Building 374. The 374 facility is currently permitted (interim status) as a hazardous waste treatment facility under Colorado Hazardous Waste Regulations. The issue is whether Building 374 can be excluded from the hazardous waste regulations under 6 CCR 1007-3, and instead be regulated under the NPDES permit system of the CWA. To meet the requirements for exclusion, a facility must meet the following guidelines:

- be "subject to" regulation under Section 402 of the CWA; and
- meet the definition of a "wastewater" under 6 CCR 1007-3.

Waste stream characterization efforts were nearing completion as of February 1994 to determine if inputs to Building 374 meet the required definition (EG&G 1993rr). However, EPA and CDH disagree on whether Building 374 is "subject to" Section 402 of the CWA. EPA policy adopts a broad interpretation that considers any treatment facility upstream of a permitted treatment facility (in this case, the STP) to be "subject to" Section 402. CDH contends that the Building 374 facility is not specifically included in the permit thus it is not "subject to" Section 402. This difference of opinion will probably be resolved by including Building 374 as a specific permitted discharge point in the new permit; however, there is no defined time frame for issuance of the new permit (as a result of other issues).

The importance of the WWTUE lies in the monitoring and reporting requirements under the different regulations. Monitoring and reporting requirements for Building 374 under CHWA regulations are extremely stringent. Effluents are analyzed on a monthly basis for a full suite of parameters. Influent sources to Building 374, including incidental waters, must be fully characterized, and updated annually. Tank inspections are performed on a daily basis. All aspects of operations must be fully documented and kept on file for three years. Notices of Violations are issued for any deviations. Under NPDES permit requirements, monitoring is generally limited to indicator parameters such as conductivity and pH, and reporting is limited to daily maximums and monthly averages. Sending incidental waters to Building 374 for treatment will be much easier under CWA regulations than under RCRA regulations.

7.7.3 Process Needs

Technologies appropriate to treatment of incidental waters must meet certain criteria, based on assumed types and concentrations of constituents, and estimated rates of flow. Incidental waters can contain suspended solids, dissolved metals, radionuclides, and inorganics, as well as organic chemicals. Of these, organics are the constituents of greatest concern because of their much higher mobility in water than the other types of constituents. Environmental concentrations of constituents are expected to be relatively dilute; thus, selected potential treatment technologies must be capable of effective treatment at low concentrations.

With the exception of organics, existing facilities at either Building 374 or the STP are capable of treating the vast majority of low-level contamination. For treatment at Building 374, high levels of suspended solids are also a concern. These facilities could continue to be used, with the addition of pretreatment at the source as needed.

Because of the diverse locations of incidental waters and generally low concentrations, pretreatment technologies should have the following characteristics:

1. Portable. Treatment systems that can be moved in and set up quickly at varying locations will alleviate the need for large storage or the need to transport suspect waters via tanker truck to a central storage location.

2. Modular. The diversity of potential contaminants requires a diversity of treatment technologies. These technologies do not necessarily need to address all potential contaminants but must be capable of handling the majority of credible contaminants.

3. Influent/Effluent Tankage. Influent tankage of 5,000 to 10,000 gallons allows for flow control to necessary treatment modules. Effluent tankage allows for water quality monitoring before disposition of the water.

4. Sediment Filtration. Although the majority of incidental waters are not expected to have high solids, prefiltration of TSS will be necessary to protect or enhance other treatment processes. Filtration may also be capable of reducing metals and/or radionuclides.

New facilities/technologies used for treatment of incidental waters should incorporate, as possible, the availability of Building 374 and the STP for further, more complete treatment. Assuming that some type of treatment is indeed necessary, the preference is to transfer this water directly to Building 374 or the STP without additional pretreatment. Analytical results will determine this need. In the primary scenario of concern, incidental waters will contain dilute concentrations of organic chemicals above that which can be treated at the STP, thus precluding treatment at either the STP or Building 374. Pretreatment using portable GAC units is the most versatile method of reducing contaminant concentrations to a level that can then be sent to the STP. A portable GAC

unit can also be used on a dilute mixed waste stream before transport to the 231 tank for treatment within Building 374.

Conversely, if the concentrations are low enough, it is possible that a portable facility may be able to effectively treat incidental water so that it can be released to the environment. Packaged mobile treatment facilities (tractor/trailer size) that use modularized processes to treat for a broad range of contaminants including solids, metals, organics, and some radionuclides are commercially available. These packaged systems have design flow rates up to 15 gpm.

Use of existing facilities at OU1, OU2, Building 910, and Building 774 for the treatment of incidental waters is not recommended. These facilities have specific capabilities appropriate to some incidental waters, but are not general enough to handle the expected diversity of waste streams without substantial retrofitting. This retrofitting would likely affect the ability of the facility to meet their primary objectives for treatment of OU-specific waters.

7.8 RECOMMENDATIONS FOR DISPOSITION AND MONITORING

The data gaps described above should be closed in order to make recommendations concerning the disposition of incidental waters. In particular, quantity and quality of incidental water need to be fully understood in the Industrial Area. For instance, if the NPDES permit sets a limit on the amount of discharge allowed, it will be necessary to know if that limit might be exceeded. A recommendation for incidental water disposition at this point would be premature and could possibly lead to future problems. Therefore, a new concept of "tightening the net" in the manner of the DGOs is the current goal.

To understand the incidental waters, which include foundation drain and building sump waters, at RFP, it is necessary to first enhance the current monitoring and incidental waters management program to be consistent with the concept presented in the draft

NPDES permit. The following list consists of recommendations for improving the *Control and Disposition of Incidental Waters* (EG&G 1993y) document and incidental/foundation waters management:

- Include waters from foundation drains, building sumps, valve vaults, pits, and subbasements as a part of the incidental waters in the CDIW if they will not be managed under the NPDES permit.

- Revise the frequency and analyte list for the foundation drain monitoring program to be consistent with the RFP storm water permit. A baseline should be established for the entire RFP TCL and TAL lists. Monitoring these analytes serves two purposes. The waters will be able to be characterized and an appropriate treatment designation will be able to be determined. Additionally, flow rates should be monitored to determine incidental water quantity and seasonal variations.

- Update the current incidental waters procedure to include TTOs as a standard parameter for sampling and analysis and set the control limit at 2.1 mg/L, as is proposed as an addition to the NPDES permit.

- Determine the types and concentrations of potential contaminants by tabulating existing foundation drain and building sump water quality data.

- Begin investigating portable packaged treatment and pretreatment facilities capable of handling expected volume, type, and concentrations of contaminated incidental waters.

- Pursue dedicated tanker truck(s) (minimum 10,000-gallon) for interim storage and/or transport of incidental waters or provide adequate storage facilities.

- Expand the parameter list and frequency of monitoring of foundation drain waters for buildings undergoing D&D activities, if appropriate. It is recommended that monitoring be done for the entire COPC list for the subbasin in which the building is located. This list may be very broad at first, but as monitoring continues, it can be condensed.

- Implement administrative policies to ensure that incidental waters from D&D activities are monitored and disposed of according to approved procedures.

- Revise the foundation drain monitoring program to ensure that the proper locations are being sampled.

- Improve the documentation and record keeping for the incidental water program including dates, volumes, and water quality data.

- Verify foundation drain locations, connections, and daylight points. This can be performed in conjunction with the DIS.

- Use appropriate water treatment methods/facilities for the constituents found in individual incidental waters, which will be determined from the recommended additions to the monitoring and sampling programs.

Table 7-9 shows the treatment facilities currently on plant site that can treat potential contaminants that may be found in incidental waters. This table does not reflect available capacity and is meant to be used as a general guide for incidental water disposition. It is important to note that currently there are no facilities onsite that appear to have the capability of handling water with all of the possible contaminants. Some existing facilities, however, could be modified. For example, a GAC pretreatment unit with storage capabilities large enough to store the incidental waters during periods of full capacity could be added to the Building 374 process waste facility. This larger capacity

TABLE 7-9
Industrial Area IM/IRA/DD
Treatment Facilities Available at RFP For Specific Contaminants
Possibly Found in Incidental Waters

Contaminant(s)	Bldg. 374	Bldg. 910	Bldg. 774	OU1	OU2	STP*
Uranium	Y	Y	Y	Y	Y	N
Plutonium	Y	Y	Y	N	Y	N
Americium	Y	Y	Y	N	Y	N
Metals	Y	Y	Y	Y	Y	N
Inorganic Chemical Compounds	Y	Y	Y	Y	N	N
Salts	Y	Y	Y	N	N	N
Suspended Sediments	Y	Y	Y	N	Y	Y
Organic Matter	N	N	N	N	Y	Y
Organics - VOAs	N	N	N	Y	Y	N
Organics - Semivolatiles	N	N	N	Y	Y	N

*Not to be used without expressed permission.

Y = Yes
N = No

STP = sewage treatment plant
VOA = volatile organic analytes

and GAC unit would allow organic compounds to be treated that Building 374 cannot currently treat.

NOTICE:

INCOMPLETE DOCUMENT

This document was distributed in an incomplete state, and the microform copy is representative of the paper copy. Section 7.1 was not listed in the Table of Contents. If replacement pages are distributed, they will be microfilmed and included in the Administrative Record file.

The Adminstrative Record Staff

APPENDIX 7.1

DETAILED DESCRIPTIONS OF BUILDING FOUNDATION DRAINS AND PATHWAYS AT ROCKY FLATS PLANT INDUSTRIAL AREA

(intentionally blank)

APPENDIX 7.1

DETAILED DESCRIPTIONS OF BUILDING FOUNDATION DRAINS AND PATHWAYS AT ROCKY FLATS PLANT INDUSTRIAL AREA

BUILDING 111 (Figure A-1).

The "Basement Floor Plan" drawings show a 4-inch tile drain around the perimeter of the basement foundation. It is unknown what backfill material around the drain system and foundation was used during the construction of Building 111. The finished grade elevation, however, is approximately 6,030 feet. The high point invert elevation of the drain is shown as being 6,025.0 feet, located in the center of the wall at the southern end of the basement. The slope of the foundation drain is toward the northeast corner of the basement where the invert elevation is shown as being 6,023.1 feet.

The outfall location for Building 111 (FD-111-1) is not shown on the engineering drawings but is stated as being north of the northwest corner of Building 111 to a drainage area (Yashan and Barros 1992). This drainage area then flows into North Walnut Creek and to the A-series ponds. During a site walk on December 6, 1993, this outfall was not specifically identified. A possible outfall location, however, was identified in the area. Samples have been collected from the drainage ditch in the past at approximately the same location where the suspected outfall was identified. This sample location has been deleted from the current monitoring program because it is usually dry, and sampling in the past has not detected any contamination. It is known that the foundation drain pipe has been rerouted as a result of the recent construction of Building 115. Although it is not certain where the foundation drain was rerouted to, Building 115 personnel speculate that the pipe was connected to the sanitary sewer. This speculation has not been verified, however, and it is recommended that the Building 111 foundation drains be dye tested to determine the correct outfall location.

Another sampling location is associated with Building 111. BS-111-2 is a building sump located in the southern part of the building's basement. This sump is believed to be collecting discharges from floor drains in Building 111. It is not certain if there is a connection between this building sump and the foundation drains.

BUILDING 124 (Figure A-2).

According to the "Foundation Plan" drawings for Building 124, there is a 6-inch perforated corrugated metal pipe that runs around the exterior of the foundation. The backfill material that was used around the drain system and the foundation are unknown. The finished grade elevation is approximately 6,040 feet, and the high point invert elevation is shown as being 6,028.73 feet at the center of the western wall. The slope of the drain is toward the east, where it discharges to a manhole located near the eastern side of Building 124. The low point invert elevation is shown as being 6,027.0 feet at this manhole. According to the drawings, discharge from the manhole is through a 15-inch pipe to an outfall located on the hillside south of the plant site. Discharge would then flow down into the southern interceptor ditch and then to pond C-2.

This outfall location no longer exists. It is not known if the foundation drain was sealed or rerouted to another system. The date that the outfall was discontinued has not been determined, either. The SWD speculates that the 15-inch discharge pipe was connected to an 18-inch storm drain located to the south of Building 124. This storm drain runs to the east and outfalls on the southern hillside south of Building 664. The outfall is sampled under the current foundation drain sampling program as FD-444/460. This connection to the storm drain has not been verified, however, and it is recommended that the Building 124 foundation drains be dye tested to determine the correct outfall location.

BUILDING 371/374 (Figures A-3, A-4).

The "Area Plot Plan, Foundation, and Storm Drains" drawing shows six outfall locations labeled with FD-371 numbers. Three of these locations are for Building 371/374 and the other three are for the 517/518 substations located to the east of Building 371/374. The foundation drains around the perimeter of Building 371/374 are shown as being 8-inch porous concrete (PC) pipe; the drains underneath the building are shown as being 6-inch PC pipe. Compacted sand was used as backfill material around the foundation/footing drains. Outfall location FD-371-1 is the storm drain located along the southern edge of the Building 371/374 and is described on the drawing as being abandoned in place. Outfall FD-371-2 is shown as being the discharge location for the basement foundation drain system. The outfall locations for FD-371-1 and FD-371-2 are to the southern end of a drainage ditch located to the southeast of Building 374. FD-371-3 is located in the same drainage ditch as FD-371-1 and FD-371-2, just to the north of a small road leading to the 517/518 substations, and is shown as being the discharge location for the subbasement foundation drain system of Building 371/374. The invert elevations of the drain systems for Building 371/374 are shown on the figures. The finished grade elevation around the building is shown on the drawings as being approximately 5,990 feet.

Outfalls FD-371-4, FD-371-5, and FD-371-6 are the subdrain system around the 517/518 substations. These drains are shown as 6-inch PVC pipe. The backfill material used around them is unknown. FD-371-4 runs to the south and discharges in the drainage ditch southwest of FD-371-3 on the south side of the road to the substations. The outfall locations for FD-371-5 and FD-371-6 are to the east of the substations to the drainage ditch that runs to the north of Building 771 where they join the discharges from FD-371-1, FD-2, FD-3, and FD-4. The water eventually enters North Walnut Creek and the A-series ponds.

During the site walks, only two of these outfalls (FD-371-2 and FD-371-3) were located. Outfall FD-371-2 was observed to be damp with no measurable flow. Outfall FD-371-3 was observed to have considerable flow. It was stated by the Surface Water Division at Rocky Flats that the basement and subbasement drain systems were connected and that all of the discharge is through outfall FD-371-3. The exact locations where the systems were connected and the date at which this occurred have not been determined. It is known that these systems are connected because the roof drains for Building 371/374 were previously connected to the basement foundation drain system. During storm events there is only a very small increase in flow rate at the FD-371-2 outfall and a significant increase in flow rate at the FD-371-3 outfall. The discharge from FD-371-2 is believed to be groundwater that enters the drain system after the point of connection to FD-371-3. Foundation drain outfalls FD-371-4, FD-371-5, and FD-371-6 were not located during site walks.

Currently, two sampling locations are associated with Building 371/374. The first sampling location is discharge from a metal culvert located near where the outfall for FD-371-1 is shown. This culvert has water flowing from it on a continuous basis. It has been determined that this water is steam condensate (EG&G 1993oo). This location is identified as FD-371-MC and samples are analyzed for the same parameters as are samples from foundation drain and sump locations. The second location is at the FD-371-3 outfall. In the past, samples were also collected from the drainage ditch in a location downgradient from FD-371-5 and FD-371-3 outfalls. This location was identified as FD-371-Composite. Because of the historical data from surface water sampling locations further downgradient and the monitoring performed through OU6, this location has been deleted from the sampling program.

BUILDING 444 (Figure A-5).

The "Foundation Plan" drawing for Building 444 shows a 6-inch foundation drain around the basement foundation. The foundation drain material or backfill material is unknown. The invert elevation is shown to be 6,008.25 feet around the entire basement except for in Area Way 2 at the southern end of the basement where the invert elevation is shown to be 6,007.0 feet. The engineering drawings do not show an outfall for the drain; however, drawings for the process waste system show a 2-inch pipe labeled as "footing drain" leading into the two sumps located approximately in the center of the basement toward the eastern side. The discharge from the sumps is to the process waste system where it is treated in Building 374.

BUILDING 447 (Figure A-5).

According to the "Floor Trenches & Underground Piping" drawing, there is a 4-inch tile drain around the western half of the basement foundation connecting to the "interceptor drain line," which runs from north to south underneath the center of the building. The backfill material used around the drains and the finished grade elevation are not shown. The high point invert elevation is shown as 6,018.0 feet located at the center of the western wall, and the drains slope to the east. Invert elevations at the point of connection to the "interceptor drain line" at the northern wall of the building and at the point of connection at the southern wall are shown to be 6,010.0 and 6,005.0 feet, respectively.

In the past, the outfall for the "interceptor drain line" was located on the hillside south of the plant site. This outfall was rerouted in 1986 to the storm drain that currently outfalls south of Building 664. This outfall is sampled under the current foundation drain sampling program as FD-444/460.

BUILDINGS 559/561 (Figure A-6).

Engineering drawings for Building 559 do not show a foundation drain system for the building; however, there is a foundation drain for the tunnel that runs between Buildings 559 and 561. An as-built drawing of Building 561 shows a pit with a 6-inch foundation drain around its exterior located in the northeast corner of the building. A similar pit was constructed with a 6-inch hel-cor foundation drain around the exterior in the southern portion of Building 559. The two pits are connected by an underground tunnel that runs between the buildings. The discharge from both of the foundation drains is to a sump located near the northwest corner of the Building 561 pit. The high point invert elevation for the Building 559 foundation drain is shown to be 85.14 feet (5,985.14) at the center of the northern wall of the pit. The drain ties into the Building 561 pit foundation drain at a low point invert elevation of 82.3 feet (5,982.3).

In the past, the water collected in the sump flowed to the west through a series of storm drains to the west of the buildings that discharged onto the hillside west of Building 516. This outfall location is known as FD-516-1. The discharge flowed north past the Protected Area and joined North Walnut Creek, which flows eastward to the A-series ponds. The outfall was being sampled in the past but was deleted from the sampling program because the sump was determined to be a more representative sampling location for the foundation drains. The new identification number for the sump is FD-559/561. Elevated levels of carbon tetrachloride have been detected in FD-559/561, and in March of 1993, the discharge pipe, which connected to the storm drain that became FD-516-1, was cut and blanked. All of the discharge from FD-559/561 is currently being routed to Building 560 where it is fed into the sanitary sewer system to be treated at the STP (EG&G 1993aa).

BUILDING 707 (Figure A-6).

The as-built engineering drawings show a 6-inch subsurface drain system beneath the building. This drain system slopes towards the west and ties into a pipe that runs along the western side of Building 707. This pipe ties into a storm drain that runs to the east at the southwest corner of the building. The storm drain collects surface water from the 700 area and outfalls at the 750 culvert into a drainage area to a 30-inch corrugated metal storm drain that leads eastward to the B-series ponds on South Walnut Creek. The foundation drain material is currently unknown, but the foundation drains are shown as being surrounded by "graded filter" backfill material. The layout of the drains and the invert elevations are shown in Figure A-6.

The current sampling points for Building 707 are a valve vault located next to the cooling tower to the south of Building 707 (BS-707-2) and at the 750 culvert outfall. The source of the water in the valve vault is assumed to be from a sump in the basement of Building 707, according to the SWD. However, from reviewing engineering drawings, it is believed that the waters sampled in BS-707-2 are from surface runoff or groundwater infiltration and are not connected to the foundation waters of Building 707. The 750 culvert is being sampled on a quarterly basis. The sample identification for this location in the past was FD-707-1 but has since been changed to 750 culvert. In the past, samples were also collected from what is described as a "process drain manhole" outside Door 3 to Building 778. This location was identified as BS-707-3. BS-707-3 is no longer sampled because the drain has been dry for one-and-one half years (EG&G 1993oo).

During the site walks, a clean-out port was observed at the southwest corner of Building 707 which may be an access port to the foundation drains. It is recommended that this clean-out port be investigated as a possible access point for future sampling of Building 707's foundation drains.

BUILDING 771 (Figure A-7).

The Foundation Drain Plan, Underground Piping, and Sewer and Drainage Lines drawings show the layout of the foundation drain system for Building 771 and three associated outfall locations at the northwest corner of the building.

The foundation drains in Building 771 are shown as a 6-inch tile foundation drain running around the perimeter of the building and connecting to an 8-inch vitrified clay pipe near the northwest corner, and a system of storm drains running under the building to the north before joining a 15-inch vitrified clay pipe that runs to the west along the northern wall. There are five exit points for these drains: three along the northern wall and two along the western wall. The drains exiting the northern wall and the northernmost drain on the west wall all lead to the storm drains that run through Manhole #3. The storm drains under the building are connected to the floor drains within the building and are also believed to be connected to the roof drains.

Some discrepancy exists about where this manhole discharges. Engineering and Utility drawings show the manhole joining the storm drain system to the northwest and flowing north to an outfall on the surface known as SW-91. Several EG&G personnel have indicated that the water from Manhole #3 was rerouted to the small pond to the north of Building 774. However, no documentation is available to verify this information.

The fifth and southernmost drain is a 6-inch corrugated metal pipe that runs briefly to the west and discharges to the surface. This water most likely joins the drainage that flows to the north and then runs east via North Walnut Creek to the A-series ponds. This outfall has not been located during site walks. The addition on the west side of the building has a 6-inch vitrified clay foundation drain that discharges to a 6-inch cast iron storm drain that flows to an outfall on the surface known as SW-91. The layout of the drain systems and the invert elevations are shown in Figure A-7.

Four sample locations have been identified for Building 771. FD-771-4 is a foundation drain sample location that was discontinued because of the construction of the Perimeter Security Zone. BS-771-2 and BS-771-3 are building sumps that were deleted from the current foundation drain sampling program because the sumps are currently being pumped to process waste. Currently, there is one sampling location for Building 771 (FD-771-1). The current FD-771-1 may not be the same as the original FD-771-1. A document from 1983, included in the 1992 document entitled *A Description of Rocky Flats Foundation Drains* (Yashan and Barros 1992), states that the original FD-771-1 was also discontinued because of the construction of the Perimeter Safety Zone. The current sample point is a grate located 50 feet southwest of the southwest corner of the old 776 guard post. During site walks, this location was buried under approximately 2 to 4 inches of mud and silt.

BUILDING 774 (Figure A-7).

The Foundation Drain Plan drawing for Building 774 shows three foundation drain systems and their outfalls. The original building construction incorporated a 6-inch tile drain around the perimeter of the building, which discharged to the ground surface north of the northwest corner of the building. During construction of the northern addition, the original building foundation drain was rerouted to an 18-inch corrugated metal pipe storm drain that outfalls northwest of Building 774 at FD-774-1. The additions on the northern and eastern sides of the building were constructed with 4-inch PVC foundation drains. The northern addition foundation drain flows to the north of Building 774 and outfalls at FD-774-2. The eastern addition foundation drain flows into a 6-inch corrugated metal pipe storm drain that runs northeast and outfalls at FD-774-3, which joins the french drain system.

Two of these outfall locations, FD-774-1 and FD-774-2, were verified during site walks in November and December of 1993. Foundation drain FD-774-1 had a considerable flow of water that drained into a pond that is contaminated with PCBs. The pond has

a posted warning sign noting contamination. From here, the water flows to the north through a storm drain to a surface water outfall known as SW-91. Foundation drain FD-774-2 was dry, and according to the SWD, it has been for many years. According to the Building 774 building manager, the groundwater flow was disrupted when the northern addition was constructed (EG&G 1993ll). Water is now collected in a basement sump and treated at Building 374.

Sample locations FD-774-2 and FD-774-3 have never been sampled, according to the SWD. Sample location FD-774-1 has been sampled at the outfall in the past but has since been moved to the collection pond and is currently being sampled at that location.

BUILDING 779 (Figure A-8).

Foundation Drain Plan and the Grading and Drainage Plan drawings for Building 779 show a 6-inch open tile foundation drain along the northern wall of the building that runs to the northeast corner. The slope of the drain is to the east with a high point invert elevation of 5,979.5 feet located at the western wall. The foundation drain is then shown as connecting to a storm drain at an invert elevation of 5,975.2 feet. Utility drawings show the storm drain running north and discharging onto the hillside north of the solar ponds.

During site walks, FD-779-1 was identified as a 12-inch corrugated metal pipe with little flow coming from it. It appears that this sampling location of the storm drain is to the east of the actual foundation drain outfall location. The discharge from both of these pipes flows approximately 50 feet down a drainage area on the northern hillside where it is collected by the French Drain - Interceptor Ditch system. The water is ultimately treated by the Building 910 evaporators. Foundation drain outfall FD-779-1 has been included in the sampling program since its initiation in August 1977.

BUILDING 850. (Figure A-9)

Building 850 is an office building, which was constructed in the 1980s. The building is not located near any IHSSs and hazardous materials have never been used or stored in the building. Building 850 currently serves as a cafeteria. Because of these reasons, drawings were not reviewed for this building. A foundation drain system does exist that runs south, past the fence line and discharges onto the hillside south of the plant site. The runoff travels into the South Interceptor Ditch system that leads to pond C-2.

BUILDING 881 (Figure A-10).

The Foundation Drain Plan, Foundation Drain Lines, Area Plot Plan, and Plumbing drawings for Building 881 show three separate foundation/underdrain systems, each discharging to different locations.

A foundation drain system is located around the exterior of the foundation. The foundation drain lines are stated as being 6-inch perforated galvanized steel, except for one section that is shown as being 6-inch vitrified clay pipe. Building 887, located to the south of Building 881, was also constructed with a foundation drain system using 6-inch perforated corrugated metal pipe. The Building 887 foundation drains are connected to the Building 881 foundation drain system. The layout and invert elevation of the foundation drain system are shown in Figure A-10. The actual outfall location is shown as being at a concrete head wall on the southern hillside of the plant site. The outfall was sampled in the past as FD-881-1, but the outfall is no longer sampled under the current foundation drain sampling program. Currently, the discharge is collected in a sump located on the southern hillside and routed to the OU1 treatment system (EG&G 1993bb).

The second system is a storm drain network located underneath the building that appears to be for the roof drains of Building 881. The storm drain pipes are shown as being 8-,

10-, 12-, and 15-inch cast iron pipes. The system discharges to a 15-inch vitrified clay storm drain near the southeast wall of Building 881. The 15-inch vitrified clay storm drain outfalls on the hillside south of the plant site. The layout and invert elevations of the storm drains are also shown in Figure A-10. The outfall was located during an informal site walk on December 29, 1993. It is located approximately 50 feet to the east of the outfall for the Building 881 foundation drain system described previously. The outfall location was damp, but no measurable flow was observed and it had a wetland appearance with numerous cattails. No previous or current sampling has occurred at this outfall. It is believed that the discharge is being collected in the french drain system located on the hillside that leads into the OU1 treatment system, but this has not been verified.

A utility tunnel drain system runs under Building 881 that is believed to be designed to intercept groundwater and prevent the utility tunnels from flooding. Drawings show the drain system to be 4-inch cast iron pipes underneath the floor of the tunnels. The discharge from this system flows to a sump that is located in the boiler room near the south end of the building. The layout and invert elevations are shown in Figure A-10. In the past, there were two sumps in Building 881, which were sampled. One of the sumps, identified as BS-881-2, is described as being located in an elevator shaft by the boiler room. It is believed that building sump BS-881-2 is also the collection point for the utility tunnel drains. This sump was deleted from the sampling program because the sample consisted mostly of oil from the elevator. The water from this sump is currently being pumped to the sanitary waste system to be treated at the STP. Other sumps located in Buildings 881 and 891 are treated at the OU1 facility (DOE 1992f). Currently, no building sumps in Building 881 are being sampled under the foundation drain sampling program.

BUILDING 883 (Figure A-11).

The Foundation Plan and Foundation Drain drawings for Building 883 show a 6-inch perforated foundation drain for the building. Also, two building sumps are associated with Building 883. The sump located in the eastern side of the building is actually a floor drain that discharges directly to a storm drain that outfalls to a ditch east of the building. This outfall was not located during site walks.

The other sump is located at the southwest corner of the building. Engineering drawings from the original building construction show the sump being connected to the foundation drains. Utility drawings show the sump being connected to a 12-inch corrugated metal pipe storm drain that discharges to the west of T883D. This water then is either absorbed into the ground or becomes surface water and runs off toward the 881 Hillside. The outfall of this storm drain was not identified during the site walks. The sump has been included in the foundation drain sampling program since it began in 1977. It was originally identified as BS-883-1 but was changed to FD-883-1 in 1992.

BUILDINGS 865, 875, and 886 (Figure A-12).

The Cast-in-Place Pile Plan drawing for Building 865 shows a 6-inch perforated asbestos subdrain. The drain is shown in two segments, both of which lead to a manhole located near the middle of the eastern side of the building. The first segment has a high point invert elevation of 5,988 feet, located at the southwest corner of the building. The drain flows to the east where it ties into a storm drain at the southeast corner of the building at an invert elevation of 5987 feet. The storm drain runs to the north along the eastern side of the building to the manhole. The second segment has a high point invert elevation of 5,988 feet at the southwest corner of the building and flows to the north along the western side of Building 865. It is joined about midway by another section of pipe that extends to the south along the western wall at an invert elevation of 5,987 feet.

The pipe then extends to the east underneath the building to the manhole at an invert elevation of 5,986 feet.

It appears that water from the manhole is pumped through a 2-inch steel pipe that outfalls on the southwest corner of the guard post at the portal to the 800 Area. This pipe was observed to be discharging when it was checked on December 22, 1993. These foundation waters need to be dye tested for confirmation. The manhole on the eastern side of Building 865 is sampled under the current program as BS-865-2.

Another sump is located outside the building near the middle of the western wall of Building 865. This sump is currently sampled under the foundation drain sampling program as BS-865-1. There is no evidence from building drawings that this sump is connected to foundation drains in Building 865.

The utility drawings for Building 886 show a 4-inch foundation drain connecting to a 6-inch corrugated metal footing drain pipe along the western side of the building. The discharge of this foundation drain is to a manhole near the southwest corner of the building. This manhole was added to the foundation drain sampling program in 1993 and were being sampled as FD-886-2.

Engineering drawings also showed a 6-inch corrugated metal pipe along the northern and western sides of the Building 886 waste pit. The discharge from the 886 waste pit foundation drains is to a 6-inch corrugated metal pipe foundation drain along the tunnel running between Buildings 886 and 875. The discharge from the foundation drain is to a sump located on the eastern side of Building 875 known as FD-886-1. Original as-built drawings show a discharge pipe from the sump to the ditch south of the sump. Discharge from the sump to the ditch has not been confirmed, though it likely did occur in the past. The backfill material used around all of the drains is shown as filter material, with 2 feet of Class 2 structural backfill on the surface.

Samples from both the sump and the manhole have shown detections of uranium in the water. As a result, they are pumped out by a vacuum truck and taken to Building 374 to be treated (EG&G 1993oo). The sump and manhole have been pumped one or two times a week for approximately the last year (EG&G 1993oo). Neither FD-886-1 or FD-886-2 has been sampled since 1992 because they are being transferred to treatment. The SWD plans to delete them from the foundation drain sampling program.

BUILDING 910.

The report entitled *A Description of Rocky Flats Foundation Drains* references a foundation drain for Building 910 (Yashan and Barros 1992). This drain was not identified on engineering drawings or site utility drawings. The collection point for the drains is reported to be a sump at the northwest corner of the building. Known as FD-910-1, the discharge from this sump is to the ground surface northeast of the building. Because drawings could not be found to support the existence of a foundation drain system for Building 910, a figure is not provided.

BUILDINGS 996, 997, 999 (Figure A-13).

Buildings 996, 997, and 999 are all underground structures located to the north and west of Building 991. The structures are all connected to Building 991 by a tunnel. The Tunnel Plan drawing shows a 6-inch asphalt-coated perforated Armco pipe as the foundation drain. The backfill material around the drains is shown as being gravel. These foundation drains run to the east to Building 996, then go south along the tunnel to Building 991. The foundation drains then join a storm drain and outfalls to the west of Building 991 into a drainage ditch that runs south and east around Building 991 to the B-series ponds on South Walnut Creek. This outfall was not located during site walks. The SWD has not located this outfall, and it is not being sampled under the current

foundation drain sampling program. The foundation drains for the three structures are shown in Figure A-13.

BUILDINGS 991/998 (Figure A-14).

The Area Plot Plan drawings for Buildings 991 and 998 show 6-inch asphalt-coated perforated Armco foundation drain pipes. Building 998 foundation drains start at the northeast corner and drain to the west, around the perimeter of the structure, then south along the western wall of the tunnel until it connects to the Building 991 system. The Building 991 drain system starts on the western wall running eastward along the northern wall. Drawings for Building 991 show the location of the drains but no invert elevations. The elevation at the bottom of the footings for the northern wall of building is shown as being 5,923.9 feet. The backfill material used around Building 991 was coarse gravel. The finished grade elevation along the north wall is approximately 5,950 feet.

The outfall for these foundation drains was originally located to the east of the northeast corner of Building 991 and was identified as FD-991-1. When the Perimeter Security Zone fence was constructed, FD-991-1 may have been rerouted. The rerouting of the drain was not documented, and the current discharge location is unknown. It is speculated by the SWD that the drain was connected to the 8-inch sanitary sewer pipe that runs to the northeast and is located just east of the northeast corner of the building. Although the utility drawings show a possible connection to the sewer system and the building manager supports this possibility, the connection still has not been verified.

A building sump is located in the southeast corner of Building 991. According to SWD personnel, SWD personnel were informed by Building 991 personnel that the foundation drain was rerouted to this sump (EG&G 1993oo). The current building manager has no knowledge of any construction within the last 10 years that would have rerouted the drains and believes the foundation drain waters to be flowing into the sewer system and

in 1992 with the sample number BS-991-2. It appears unlikely that the foundation drains were rerouted to the sump, although the sump may be a collection point for groundwater. Most of the underground structure for Building 991 is at an elevation 5 to 10 feet below the elevation of the foundation drain. There is also an 8-inch storm drain located in the utility tunnel under the northern half of Building 991. Drawings show that this drain connects to the foundation drain at the northeast corner of the building.

The Building 991 foundation drain also flows out the western side of the building to a storm drain that outfalls to the west of Building 991 into a drainage ditch that runs south and east around Building 991 to the B-series ponds on South Walnut Creek. This outfall is believed to be an outfall for Buildings 996, 997, and 999 also, but this has not been verified. This outfall was not located during site walks.

BUILDING 995.

Building 995 houses the STP. Although this facility does appear to have foundation drains associated with it on the engineering and utility drawings, it is not located in the Industrial Area and was therefore considered to be out of scope. Information on the Building 995 foundation drains is being researched as a part of OU8.

(intentionally blank)

8.0 CONCEPTUAL SITE MODEL

The conceptual site model for the RFP Industrial Area addresses the potential contaminant transport pathways associated with existing sources of contamination, including designated IHSSs in the nine Industrial Area OUs, PCB sites, UBC areas, routine effluents, and potential sources where release of chemicals may occur, such as product or waste storage locations, building-specific sources, or other possible sources in the Industrial Area. Contaminant migration from existing or potential sources is assessed by examining two scenarios: current or actual conditions, and the occurrence of unplanned events.

Development of the conceptual site model was based on draft conceptual models of each of the nine OUs in the Industrial Area and media-specific information from the evaluations of existing environmental monitoring systems presented in earlier sections of this report. The combined information has been consolidated and summarized to provide a general conceptualization of potential contaminant migration from sources in the Industrial Area. Appropriate EPA guidance documents were used including *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988) and *Risk Assessment Guidance for Superfund - Volume I, Human Health Evaluation Manual (Part A)* (EPA 1989b).

A conceptual site model generally addresses each component of a completed exposure pathway including the contaminant source, release mechanism, transport medium, exposure route, and receptor (Figure 8-1). However, for purposes of this document, only the contaminant source, release mechanism, and transport medium are evaluated in the Industrial Area's conceptual site model. Because this IM/IRA/DD focuses on early identification of potential contaminant releases from the Industrial Area, examination of potential exposure routes and identification of potential receptors were not included in the conceptual site model.

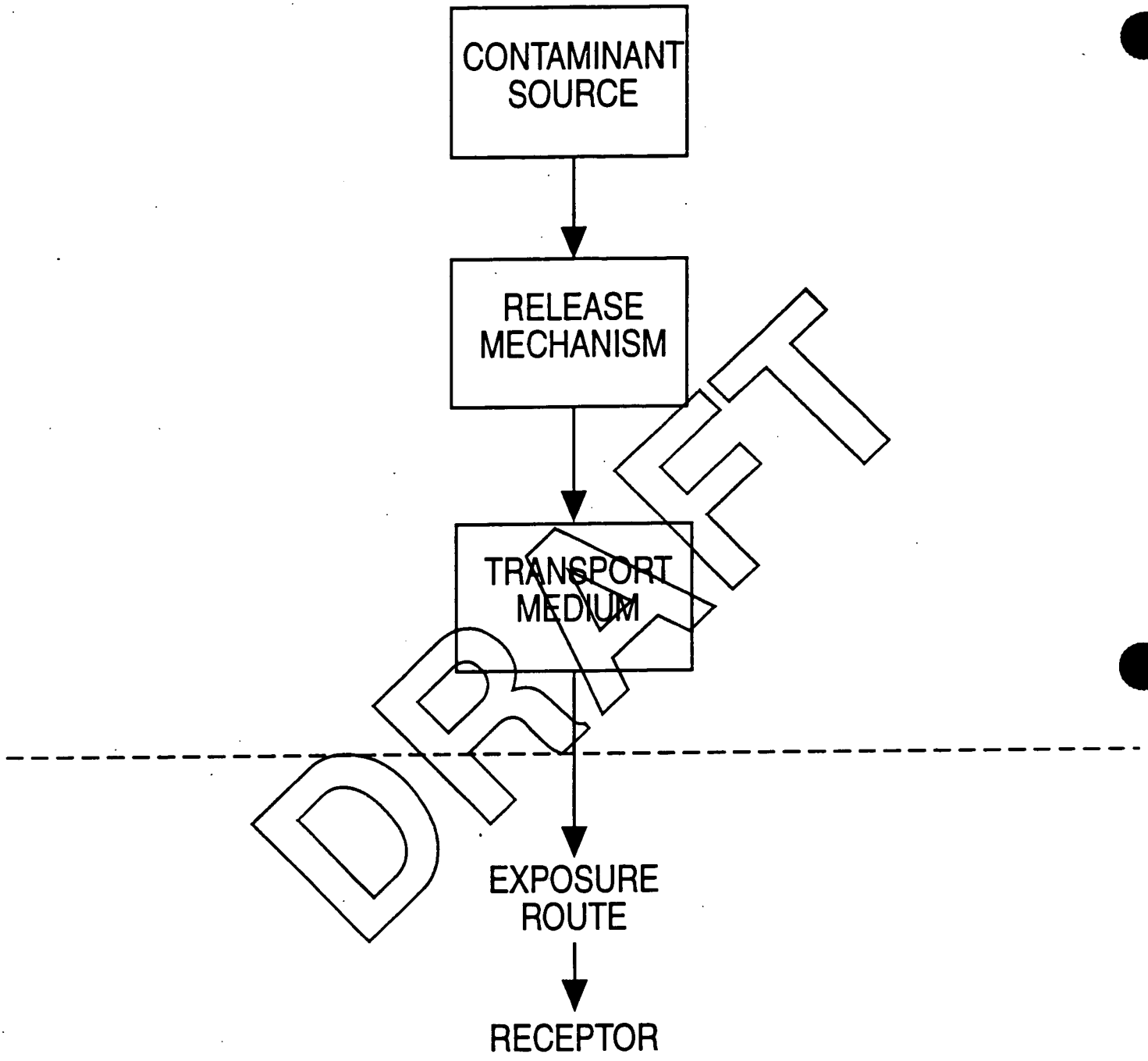


FIGURE 8-1
Industrial Area IM/IRA/DD
Components of a Completed Exposure Pathway

8.1 CONTAMINANTS OF POTENTIAL CONCERN AND SOURCES

The COPCs for soil, surface water, and groundwater were identified in Section 3.0 (Appendix 3.1). The appendices also contain a separate COPC list for the airborne contaminant transport pathway (Appendix 3.2). The appendices provide a comprehensive listing of chemicals or radionuclides that may exist at the numerous potential contaminant release sources in the Industrial Area (Appendices 3.3 and 3.5). The extensive COPC list allows preliminary identification of contaminants that currently exist or that could potentially be released and transported in site soils, groundwater, surface water, sediment, or air.

COIs were also presented in Section 3.0 (Appendices 3.6 through 3.8) to address potential releases associated with unplanned events. The number of COIs is also extensive because of the consideration of chemical product and waste stream inventories and to ensure that substances stored in the Industrial Area that were not on the COPC list are included in the evaluation of environmental monitoring systems. Such substances include specific product materials stored in buildings and the ChemRisk list of Materials of Concern (CDH 1992).

The COPCs were identified by evaluation of available information regarding historical releases in the Industrial Area, chemical product inventories, chemical waste streams and waste storage, radionuclides and special nuclear material (SNM) stored in buildings in the Industrial Area, and contaminants associated with UBC. The list of COIs was compiled from an evaluation of chemical product and waste stream inventories and information related to historical production activities at RFP.

Current sources of contamination within the Industrial Area include designated IHSSs within the nine OUs in the Industrial Area (Appendix 3.3), PCB sites (Appendix 3.4), UBC areas (Appendix 3.5), and building-specific release points such as exhaust vents and foundation drains. Potential sources where releases could occur during an unplanned

event include permitted waste storage areas, product storage areas, or accidental releases during a fire or explosion in the Industrial Area. Because the number of specific sources is too great to identify each source specifically in the conceptual site model, existing sources of contamination and potential sources were grouped into general source types based on similarities in release mechanisms. The general groupings facilitated development of the conceptual site model flow diagrams. Primary and secondary sources have been identified in the Industrial Area's conceptual site model.

A primary contamination source is the principal origin of contamination. Chemical or radioactive constituents associated with the primary source may have been released in a historical incident and are being transported in the environment or chemicals may potentially be released from the primary source in an unplanned event. Under current conditions, primary sources include the following:

- locations of historical spills, leaks, or overflows from aboveground or belowground tanks, pipelines, sumps, valve vaults, drums, containers, dumpsters, cooling tower blow-down pipes and retention ponds, OPWL, and other release sources;
- UBC resulting from past spills, leaks, or overflows;
- past fire locations;
- past decontamination areas;
- past waste disposal sites including burn pits, ponds, metal destruction sites, drum burial locations, and buried fire debris;
- current and former waste storage areas for drums, containers, dumpsters, equipment, scrap metal, building construction debris, pondcrete, and saltcrete;

- routine effluents from building exhaust stacks and ventilation systems; and
- incidental waters from building floor, foundation drains, sumps, valve vaults, or other sources.

In the unplanned event scenario, primary sources include (1) aboveground and belowground product and waste storage tanks, associated piping, and sumps; (2) drums and containers used for storage of chemical waste or product; (3) building exhaust stacks and ventilation systems; and (4) incidental waters from building floor and foundation drains.

A secondary source is generally the receiving media of the released material, such as surface water, soil, sediment, or groundwater. Air is not considered a secondary source because it is considered only to be a transport medium. A chemical released to the air may be transported directly to a receptor or eventually deposited by particulate deposition, washout, or rain out into surface soil or surface water, which is the secondary source.

8.2 PATHWAYS

The evaluations of each medium's environmental monitoring system presented in previous report sections included identification of potential sources of contamination and characterization of possible contaminant migration pathways specific to the particular medium. A transport or migration pathway consists of a release mechanism and transport media. The conceptual site model for the Industrial Area summarizes the general types of sources and identifies contaminant release mechanisms and transport media. Figures 8-2 and 8-3 present the conceptual site models for the current and unplanned events scenarios, respectively. As shown in the figures, primary and secondary release mechanisms and transport media are defined for the primary and secondary sources, thereby addressing all potentially affected media. Figures 8-4 and 8-5 provide schematic representations of the current and unplanned event conceptual site models, respectively.

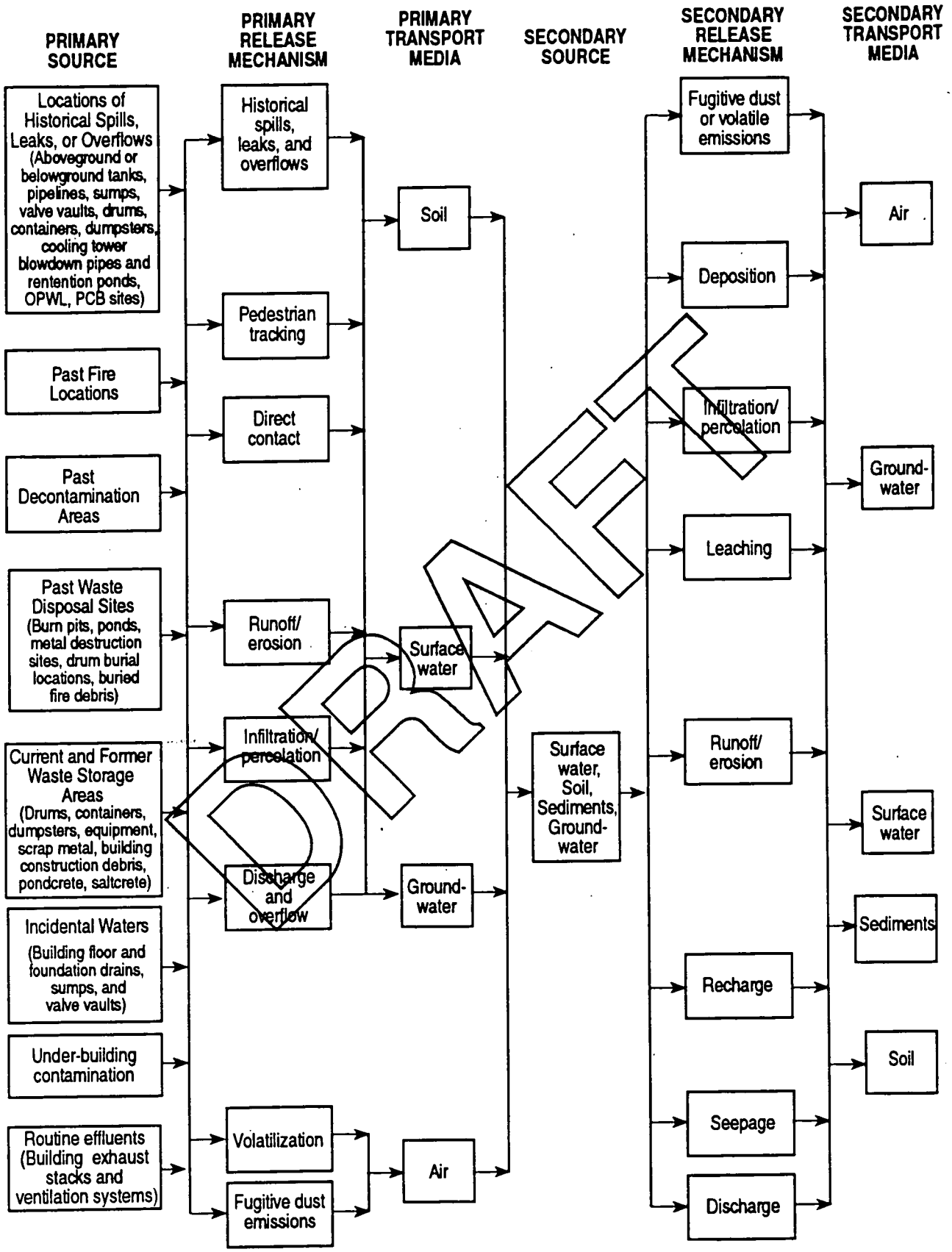


FIGURE 8-2
Industrial Area IM/IRA/DD
Conceptual Site Model Flow Diagram
Current Scenario

100% RECYCLED

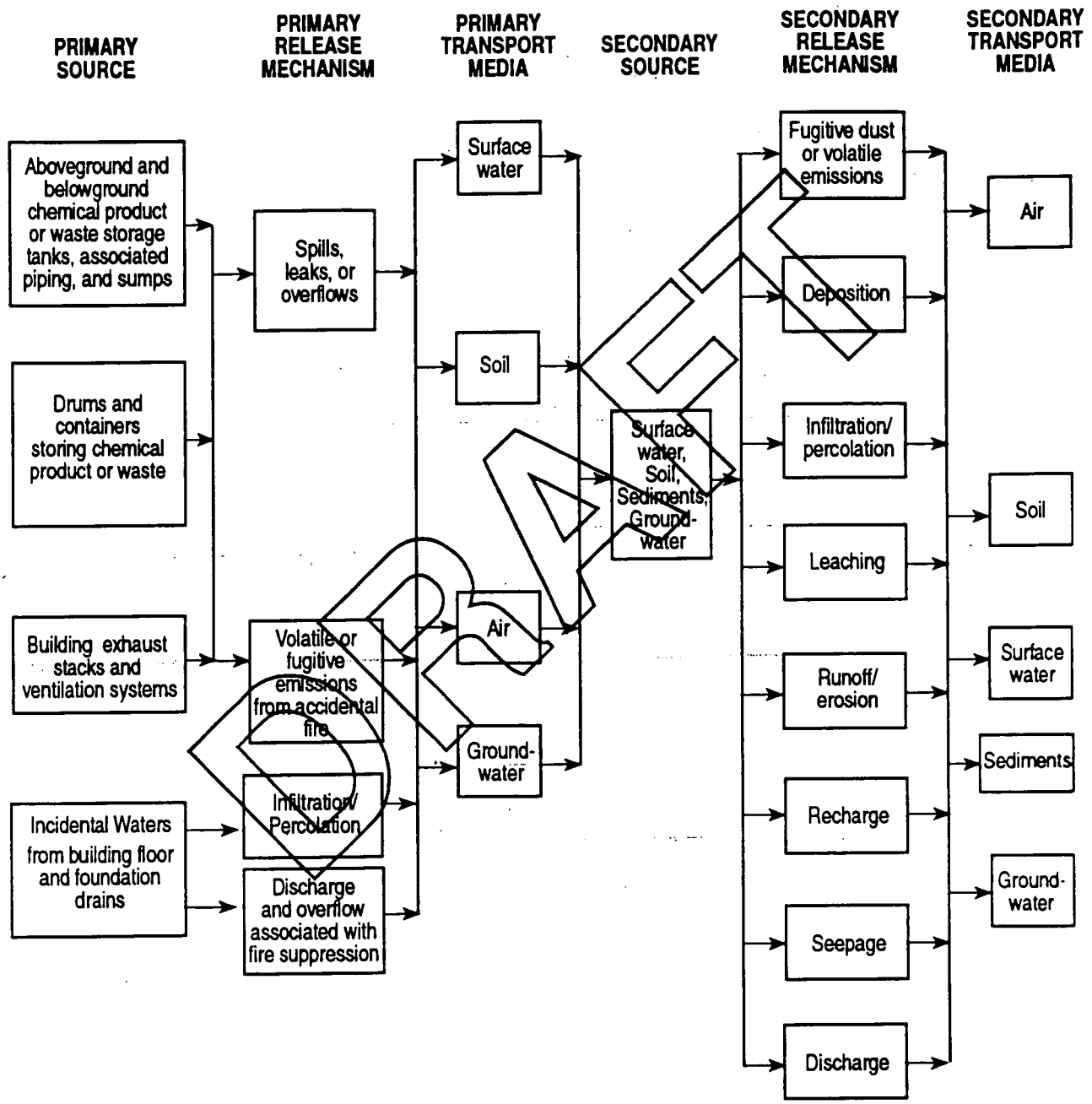


FIGURE 8-3
Industrial Area IM/IRA/DD
Conceptual Site Model Flow Diagram
Unplanned Event Scenario

8.2.1 Primary Release Mechanisms

Release mechanisms for primary sources under the current scenario include the following:

- historical spills, leaks, or overflows;
- volatilization from contaminated soils and surface waters;
- fugitive dust emissions from contaminated surface soils;
- runoff, erosion, or overland flow of contaminated soil or surface water;
- infiltration and percolation of contaminants through soil;
- discharge and overflow from building foundation drains;
- volatile or fugitive dust emissions and pedestrian tracking of contamination associated with historical spills or fires;
- routine effluents from building exhaust stacks and ventilation systems; and
- direct contact with radioactively contaminated equipment.

Under the unplanned events scenario, the primary release mechanisms include (1) potential spills, leaks, or overflows from aboveground or belowground tanks, pipelines, sumps, or valve vaults; (2) potential spills, leaks, or overflows from drums or containers; (3) volatile or fugitive emissions from an accidental fire; and (4) discharge and overflow associated with fire suppression activities.

8.2.2 Primary Transport Media

Primary transport media are the media directly affected by the initial contaminant release. The affected media will be influenced by the source type and the specific release mechanisms. Transport media may be air, soil, surface water, or groundwater.

Airborne transport may occur as a result of routine emissions, volatile emissions from soil and surface water, and windblown surface soil migrating as fugitive dust. Airborne contaminants may be transported directly to a receptor or eventually be deposited to a secondary source such as surface soil, sediment, or surface water by particulate deposition, rain out, or washout. Contaminants released directly to the soil can be transported to a secondary source by infiltration and percolation, leaching, overland runoff, or erosion. Contaminants may be transported by surface water in overland runoff when direct release to surface flow occurs. Releases from belowground tanks and piping, UBC, or buried sources may leach into surrounding soils or, as is the case with UBC, may be directly released to groundwater.

8.2.3 Secondary Sources

Contaminant migration is further characterized within the conceptual site model by identification of secondary sources. A secondary source is generally the receiving medium or primary transport medium, such as soil, surface water, or groundwater, where further release of contamination may occur.

Most of the IHSSs were given their designations as a result of historical spills, leaks, or overflows from a tank or drum, for example. In most cases, contamination was released directly to the soil; therefore, surface soil is the secondary source. Subsurface soil may become a secondary source (1) by infiltration and percolation and resultant leaching of

chemicals from contaminated surface soil or (2) from infiltration and percolation of contaminated surface water in unlined drainages or retention ponds.

Contamination from UBC areas or past underground leaks may be released directly to groundwater, which would then be the secondary source. Surface water as a secondary source may occur as a result of (1) direct discharges to drainages, as with outfalls of building footing and foundation drains, or (2) the migration of runoff from contaminated surfaces. Similarly, sediment can be a secondary source as a result of the erosion of contaminated surface soil into surface water sources or adsorption of surface water contaminants to bottom sediments.

Contamination from many of the existing sources, such as IHSSs associated with historical incidents, may have already migrated to secondary sources. Unplanned releases may migrate to a secondary source, although RFP has emergency response requirements in place and onsite hazardous materials response teams that respond and take necessary steps for containment, control, and cleanup.

8.2.4 Secondary Release Mechanisms

Release mechanisms for secondary sources will be similar regardless of the scenario considered. When soil is the secondary source, contamination can be further transported in the following ways:

- fugitive dust or volatile emissions;
- erosion to adjacent soils or nearby drainages, or
- infiltration and percolation and subsequent leaching to groundwater.

Groundwater transport of contaminants may affect surrounding soils as a result of infiltration and percolation or recharge. Some adsorption to soils may occur, or volatilization of groundwater contaminants through the soil to the atmosphere may occur.

These processes will depend on the soil type and the contaminant's physical properties. Groundwater may also release contaminants in surface seeps or, in the case of incidental waters, from building footing drain outfalls resulting in soil and possibly surface water contamination.

Surface water can transport dissolved contaminants or contaminants adsorbed to suspended matter in overland runoff or in natural or man-made drainages. Infiltration and percolation of contaminated surface water through the soil can occur that may lead to contaminant contribution to subsurface soils and potential leaching to groundwater. Sediment transport in drainages will be influenced by water flows. Airborne releases of contaminated sediments as fugitive dust may occur during periods of low flow.

8.2.5 Secondary Transport Media

The transport pathway will continue as contaminants migrate through the environment over time. A secondary transport medium is the medium where contamination from a secondary source has been deposited as a result of the secondary release mechanism.

Secondary sources may allow further contaminant releases to other media. For example, secondary soil sources may contribute to subsurface migration in groundwater as a result of infiltration, percolation, and subsequent leaching to the groundwater aquifer. Windblown fugitive dust emissions from a secondary soil source may be deposited to other surface areas or waters where additional transport could occur. Erosion and runoff of contaminated soils to surface drainages will allow surface water or sediment transport.

Groundwater seeps released to surficial soils may reenter the groundwater system via infiltration and percolation, or airborne transport may occur from contaminant volatilization or fugitive dust emissions of the contaminated surface soil. Contaminants released in groundwater seeps and building foundation drain outfalls may migrate in surface water or sediments in natural drainage channels.

8.3 RELATIONSHIP OF THE CONCEPTUAL SITE MODEL TO CURRENT MONITORING PROGRAMS

To evaluate the relationship of transport pathways identified in the conceptual site model to existing monitoring programs, it is necessary to summarize the current monitoring and then evaluate its adequacy in terms of monitoring for potential releases in the Industrial Area. The following subsections summarize current monitoring for each medium and address the adequacy of current monitoring. This is completed by evaluating sample locations relevant to potential contaminant sources and transport pathways and comparing analytes of the current monitoring systems to the list of COPCs. The relationship of the conceptual site model to current monitoring programs is then summarized for the medium, including how recommended changes to monitoring will improve detection of contaminant releases within the Industrial Area.

8.3.1 Groundwater

According to the conceptual site model, groundwater is a primary transport medium, a secondary source of contamination, and a secondary transport medium in the Industrial Area. Contamination may be released to groundwater from (1) infiltration, subsequent leaching of soil and surface water contaminants and percolation to the water table or (2) direct interaction between building foundation drains and the shallow bedrock of the upper hydrostrategraphic unit.

8.3.1.1 Summary of Current Monitoring

The RFP groundwater monitoring program determines background analyte values, concentrations of hazardous and nonhazardous constituents, and the nature and extent of contaminant plumes including the rate of plume migration. Wells in the monitoring program are designated according to their purpose and applicable regulatory requirements. The current groundwater monitoring system addresses data needs for

background monitoring, RCRA regulatory requirements, RCRA characterization monitoring, CERCLA requirements during remediation, assessment of groundwater conditions at the RFP boundary, and other special purpose monitoring.

Table 4-3 listed 183 wells in the Industrial Area and included information on their current status (as of October 14, 1993). Of the 183 wells in the Industrial Area, 155 are active, 23 are abandoned, and five are currently inactive. Figure 2-6 shows the locations of groundwater wells in the Industrial Area and indicates well class, whether the well is active, inactive, or abandoned, and the screened interval of each well (bedrock, alluvium, or alluvium/bedrock). The active wells include 34 RCRA wells, six RCRA characterization wells, 66 CERCLA wells, and 36 special purpose wells. Thirteen active wells did not have a well class identified in Table 4-3. It is important to note that the monitoring well network frequently changes to most efficiently meet current regulations and technical goals and technical and to streamline sampling efforts.

Quarterly samples are currently collected from 97 of the 183 wells in the Industrial Area including 25 RCRA wells, six RCRA characterization wells, 62 CERCLA wells, one special purpose well, and three other active wells. The wells that are sampled quarterly often change or additional wells are added to the sampling network according to the needs of the program. All wells are analyzed for the constituents identified in Table 4-4. SVOCs are analyzed only during the first quarter after installation of a new well. If SVOCs are detected during the initial analysis, they continue to be analyzed during subsequent sampling from that location.

8.3.1.2 Comparison of Existing Monitor Well Locations With Potential Transport Pathways

Groundwater flow was discussed in Section 4.2. In the upper hydrostratigraphic unit, flow is generally eastward, except along the northern perimeter and southern boundary of the Industrial Area where paleodrainage influences exist. The paleodrainages

introduce a northeasterly flow component east of Building 374 and a north-northwesterly flow northwest of Buildings 556 and 559. A south-trending paleodrainage exists south of Building 881, and another trends east in the vicinity of Building 991. Flow in the lower hydrostratigraphic unit is also eastward following the shallow dip of the strata. Because the bedrock surface somewhat resembles the surficial topography, drainage and flow pathways for surface water and groundwater, respectively, may correspond in regard to potential transport of contaminants in the Industrial Area.

The following potential contaminant transport pathways were identified for groundwater:

- horizontal migration in the upper hydrostratigraphic unit with groundwater flow away from paleotopographic ridges and along paleotopographic drainages;

- vertical migration within the upper hydrostratigraphic unit corresponding to hydraulic gradients and influenced by seasonal recharge;

- possible vertical migration via percolation from the upper hydrostatigraphic unit to the lower hydrostratigraphic unit;

- possible vertical and horizontal migration in the sandstone units of the Laramie Formation as a result of recharge from building footing drains completed in bedrock and influenced by downward hydraulic gradients;

- alluvial groundwater discharges at springs and seeps; and

- limited discharges to stream drainages.

The summary of existing data presented in Section 4.5 noted that groundwater contamination has most consistently been detected within the OUs evaluated in the *Well Evaluation Report* (EG&G 1993a). Several source areas were identified that are

currently contributing to groundwater contamination at RFP. Specifically, constituents have been detected in wells in the vicinity of the Solar Evaporation Ponds (OU4); the 903 Pad, Mound, East Trenches, and East Spray Field (OU2); the Present Landfill (OU7); the area around the 881 Hillside (OU1); and along the length of the Walnut Creek drainage (OU6). All of these sources are located in the Industrial Area, except OU6 and OU7. The Solar Ponds, the 903 Pad area, and the Upper South Walnut Creek area near the Industrial Area boundary (Mound Area) have also been identified as sources of surface water contamination in the 1989 and 1990 Surface Water and Sediment Geochemical Characterization Reports (EG&G 1992j; 1992k). Recent (November/ December 1993) groundwater sampling has also identified groundwater contamination in the central Industrial Area, as described in Section 4.6.

Plates 4-1 and 4-2 showed wetland/seep locations where groundwater from the upper hydrostratigraphic unit may discharge. The discharge may allow surrounding soils to become contaminated as a result of recharge and infiltration. Contaminant migration to nearby surface drainages via overland flow may also occur. IHSSs or UBC areas located upgradient of the seeps may contribute to contaminant loading of the groundwater discharging at wetland/seep locations. In the Industrial Area, wetlands/seeps can be associated with surface water drainage pathways described in Section 5.4. The pathways northwest of Building 111; east, southeast, and northeast of Building 374; and near the northwestern Industrial Area boundary are situated along surface water drainage Pathway 3. Additional seeps exist near the southwestern Industrial Area boundary and flow into surface water drainage Pathway 5. A seep area west of Building 991 lies in surface water drainage Pathway 2. An extensive area of seepage occurs north of the ITS. This area may drain to surface water Pathways 3 or 6. Further evaluation of surface water drainages and transport pathways relative to the conceptual site model is provided in Section 8.3.2.

UBC has been identified at 31 buildings in the Industrial Area according to the *Historical Release Report* (EG&G 1992f). These potential source areas may be contributing to

groundwater contamination within the Industrial Area. Results of aperiodic sampling of building sumps and foundation drains have shown chemical and radionuclide constituents at some locations. Table 5-24 identified building foundation drains and their flowpaths. Contaminants released in an unplanned event could enter groundwater along these flow paths.

The *Well Evaluation Report* (EG&G 1993a) determined that most well-defined groundwater contaminant plumes at RFP exist in both the unconsolidated surficial deposits and in bedrock; concentrations of some contaminants are higher in bedrock than in alluvial groundwater. These concentrations may indicate vertical migration of groundwater contaminants. As mentioned previously, 97 wells in the Industrial Area are sampled quarterly under the current monitoring program. Of these 97 wells, approximately 83 wells are screened in the upper hydrostratigraphic unit, 10 are screened in the lower unit, and four are transitional wells.

8.3.1.3 Comparison of Monitoring Analyses With Constituents of Potential Concern

A comparison of the list of groundwater analytes in Table 4-4 to the list of COPCs in Appendix 3.1 showed that all of the inorganic analytes (metals and radionuclides) are included in the list of COPCs, except copper, cyanide, percent solids, and sulfides, and that all of the organic analytes are included in the list of COPCs, except trans 1,2-dichloroethene. No COPC semivolatiles, pesticides, or PCBs are identified as groundwater analytes. Of the anions listed as groundwater analytes, cyanide, orthophosphates, and nitrite (as N) are not included as COPCs. The indicator TSS was also not identified as a groundwater analyte.

8.3.1.4 Summary of Relationship to the Conceptual Site Model

An examination of existing well locations relative to potential sources that may contribute to groundwater contamination was conducted as part of the evaluation of existing monitoring programs in Section 4.6. The evaluation determined that groundwater monitoring is generally adequate for IM/IRA purposes in the eastern Industrial Area. RCRA monitoring and CERCLA monitoring of OU2 and OU4 provide data that are useable for monitoring releases in the eastern portion of the Industrial Area.

Because groundwater monitoring in the western and central Industrial Area was not considered adequate for early detection of releases to groundwater, 37 existing wells and piezometers were recommended for incorporation into the routine groundwater monitoring program. (Table 4-6 and Figure 4-5.) Installation of several new wells was also recommended for the central Industrial Area. (Table 4-7 and Figure 4-6.)

Additional monitoring and use of OU characterization data that become available will improve the identification of groundwater transport pathways and allow early detection of current and unplanned contaminant releases in the Industrial Area. Locations recommended for inclusion in the monitoring network were selected to address identified data gaps in current monitoring. Some locations were chosen based on consideration of potential sources and likely contaminant migration pathways in the groundwater flow. Others were sited to adequately address upgradient sources or the extent of contaminant migration. The recommendation for new wells to be added to the network includes 11 additional wells in the alluvial portion of the upper hydrostratigraphic unit and two wells to detect potential releases in the Laramie Formation.

8.3.2 Surface Water

The conceptual site model shows that surface water and sediment are primary transport media, secondary sources of contamination, and secondary transport media in the

Industrial Area. Contaminants may be released to surface water drainages within the Industrial Area as a result of runoff and erosion from historically contaminated IHSSs; groundwater seeps; building foundation drain outfalls; or an unplanned event such as a spill, leak, or overflow. Surface water ponds located in the Industrial Area include the Solar Ponds and cooling tower blow-down retention ponds. The ponds may have received chemical constituents from historical discharges to the pond waters.

8.3.2.1 Summary of Existing Monitoring

The current surface water and sediment monitoring program at RFR includes (1) monitoring conducted for regulatory compliance; (2) DOE-required operational monitoring; and (3) other activities such as event-related monitoring, pond effluent treatment research, and various nonroutine support activities. Appendix 5.1 provided specific information regarding the current program. The evaluation of existing monitoring in Section 5.2 focused on NPDES storm water monitoring locations, the Event-Related Surface Water Monitoring Program, and monitoring at the STP, all of which were deemed pertinent to the Industrial Area. The NPDES storm water permit is currently under agency review.

8.3.2.2 Comparison of Existing Sample Locations With Potential Transport Pathways

The NPDES storm water monitoring locations were summarized in Table 5-1 and shown in Figure 5-1. Current monitoring is limited because of the NPDES storm water permit review. Two stations, SW023 and SW027, are currently monitored. Monitoring will resume at location SW093, SW022, and SW118 in March 1994 as part of the Event-Related Storm Water Monitoring Program's network. Location SW023 is located just inside the Industrial Area boundary along South Walnut Creek at the STP and receives 100 percent of its drainage from the Industrial Area. The second station, SW027, is located along the South Interceptor Canal at Woman Creek and receives 18 percent of

its total drainage from the Industrial Area. One other location will be deleted from the program because it does not receive runoff from the Industrial Area.

Thirteen of the 21 gaging stations under the Event-Related Storm water Monitoring Program are delineated as long-term stations. These stations are GS-1 through GS-13 (Figure 5-1). One station, GS10, is co-located with SW023. It is the only gaging station within the Industrial Area boundary. The other gaging stations are situated along the various surface water drainages outside the Industrial Area.

Monitoring of pH and conductivity is currently conducted at the STP. Influent to the plant includes drainage from the building foundation drain at Building 559/561 and possibly other buildings in the Industrial Area.

Seven specific drainage pathways that receive runoff in the Industrial Area were identified in Section 5.4. The various Industrial Area subbasins that drain storm water to the drainage pathways and the seven separate pathways were shown in Figure 5-2. The drainage pathways link the various subbasins and are monitored at the six storm water NPDES stations. Contaminants may be transported within the drainage pathways in surface water or sediments carried in runoff from potential sources along the pathways, including groundwater discharges at seep and foundation drain locations or in flow occurring from an unplanned event such as a spill, leak, or overflow. Monitoring locations along the pathways are described in the following paragraphs.

Drainage Pathway 1 receives drainage from most of the Industrial Area south of Central Avenue. Approximately 30 major RFP buildings are located in this drainage pathway (Table 5-23). Incidental waters from foundation drains of Buildings 865 and 883 are discharged to this drainage pathway. Surface water sampling location SW022 is located along Pathway 1 where it exits at the eastern Industrial Area boundary in Subbasin CSWAA6. Sampling at this location is anticipated to resume in March 1994 under new storm water permit monitoring requirements.

Pathway 2 receives drainage from subbasins in the east-central portion of the Industrial Area. A wetland/seep area near Building 991 is situated along this pathway. More than 30 major buildings are located in Pathway 2. The Building 707 foundation drain outfall flows to Pathway 2. Location SW023 (GS10) is located along Pathway 2 in Subbasin CSWAB5 near the eastern Industrial Area boundary. This station is currently sampled by USGS for evaluation of seasonal water quality and will be included in planned NPDES requirements.

The west-central, northwest, and northern portions of the Industrial Area drain to Pathway 3. Several wetland/seep areas exist along this drainage. More than 30 major buildings are located in Pathway 3. Foundation drain outfalls from Buildings 111, 371/374, 517/518, 559-560, 771, 774, and 790 drain to this pathway. Tank 207 also is located in this pathway. The ITS collection system affects this pathway in Subbasin CWAC7; only the area north of the ITS drains to Pathway 3. Location SW118 in subbasin CWAC5 lies along Pathway 3 at the northwest Industrial Area boundary. Location SW093 is downstream of SW118 on Pathway 3 just outside the Industrial Area and north of the ITS. Monitoring at both these locations will also resume in March 1994 under new stormwater permit requirements.

Pathway 4 is situated at the western boundary of the Industrial Area, draining the westernmost subbasin. Buildings 130 and 131 are situated within this drainage pathway. No foundation drain outfalls discharge to Pathway 4. Location SW998 lies along Pathway 4 before it enters the McKay Diversion Canal. This sampling location is planned to be deleted from the NPDES monitoring network.

Pathway 5 consists of several drains at the southern portion of the Industrial Area that collectively drain toward the SID. Wetland/seep areas are located along this pathway at the southwestern Industrial Area boundary. Ten buildings are situated in Pathway 5. Buildings 444 through 460 and Building 850 foundation drain outfalls discharge here as well. Three gaging stations (GS19, GS20, and GS21) are located at the southern

Industrial Area boundary at drain outfalls to Pathway 5. However, these locations are not designated as permanent gaging stations and will eventually be deleted from the event-related program.

The portion of the northeast quadrant of the Industrial Area located southeast of the ITS drains to Pathway 6. Building 964 is the only major building located in Pathway 6. No foundation drain outfalls are in this pathway. Gaging station GS-13 is located at the intersection of this pathway and the North Walnut Creek drainage outside the Industrial Area. This permanent station is in the Event-Related Storm water Monitoring Program and is currently sampled by USGS to evaluate seasonal water quality.

Pathway 7 is the interceptor trench system north of the Solar Pond that collects surface water runoff and seeps in the Solar Ponds area. Ten major buildings are located in this pathway. No foundation drains discharge to this pathway. The 207 Solar Ponds are also located in Pathway 7. Monitoring in this area is not pertinent to this IM/IRA because the water is collected for eventual treatment as part of OU4 remedial activities.

8.3.2.3 Comparison of Monitoring Analyses With Constituents of Potential Concern

Samples collected from the two NPDES stations are analyzed for the constituents listed in Appendix 5.1. The analytes correspond to the surface water COPCs listed in Appendix 3.1. Analyses listed in Table D of Appendix 5.1 are not permit driven but are conducted for research purposes.

Specific monitoring requirements of the forthcoming stormwater permit have not yet been determined by EPA. Analytes for samples currently collected in Event-Related Storm-water Monitoring Program activities are listed in Appendix 5.1. The event-related monitoring includes analyses for TCL, SVOCs, and pesticides/PCBs, although these chemicals are not identified as COPCs for surface water at RFP (Appendix 3.1). All of the other listed analytes, except a few radionuclides, are included in the list of COPCs

in Appendix 3.1. Radionuclide COPCs for surface water, which are not monitored, include strontium-89 and -90, cesium-137, and radium-226 and -228. Tritium is monitored at stations GS-11, GS-12, and GS-13 only. Water quality parameters included in the analyses encompass the COPC anions and are more extensive for the event-related monitoring. Field parameters identified for surface water in Appendix 3.1 that are not currently monitored include pH, temperature, and dissolved oxygen.

Influent to the STP is currently monitored for pH and conductivity. The influent is further tested using respirometry methods to determine the presence of contaminants that might upset the microbial treatment processes. Operational monitoring for DOE orders (Appendix 5.1) is also conducted on the STP influent. Analytes that correspond to the COPC list in Appendix 3.1 include gross alpha, gross beta, nitrate, tritium, plutonium, americium, uranium, and various field parameters. NPDES/FFCA compliance sampling is conducted on the plant effluent. (See Table A of Appendix 5.1.) Analytes that correspond to the list of COPCs include TAL metals, CLP volatile organics, and TSS.

8.3.2.4 Summary of Relationship to the Conceptual Site Model

Section 5.4 described the drainage patterns for each of the seven drainage pathways in the Industrial Area including subbasin outlets in the pathway, major buildings in the subbasins, the acreage of the area drained to each subbasin, and drainage destinations. Surface water runoff caused by precipitation at or in the area of the building will drain to the identified pathway. Table 5-23 provided a cross-reference of buildings to the various pathways.

Buildings in the subbasins may be potential sources of chemical release during an unplanned event. Flow from a spill, leak, or overflow outside a particular building may follow the drainage pathway identified in Table 5-23. Inside spills, leaks, or overflows could enter the building foundation drain, which may then carry contaminants to a surface water pathway (or groundwater pathway, depending on the situation). Flow

pathways of buildings with foundation drains currently known to lead to a surface water drainage pathway were provided in Table 5-24.

Sources of contamination that may currently contribute to contaminant migration in runoff or overland flow along the drainage pathways may include foundation drain outfalls from buildings with possible UBC, runoff from IHSSs or PCB sites, and groundwater seeps. Table 8-1 lists buildings, IHSSs, PCB sites, and UBC locations in the Industrial Area that may contribute to contaminant transport in the various drainage pathways. The table also lists possible contaminants associated with the identified IHSSs and UBC sites.

Although a number of data gaps in the current monitoring program were identified in Section 5.5, contaminant migration along the surface water drainage pathways was characterized in the 1989 and 1990 Surface Water and Sediment Geochemical Characterization Reports (EG&G 1992j; 1992k). Information from these reports confirms transport pathways set forth in the conceptual site model. Findings of the studies were discussed in Section 5.3.

In the 1989 study, 25 surface water or sediment stations were sampled that are pertinent to the Industrial Area. Areas of surface water contamination identified in the Industrial Area included the Solar Ponds area (OU4), the 903 Pad area (OU2), and the Upper South Walnut Creek area near the northeastern Industrial Area boundary (OU2 Mound area). The 1989 study reported the greatest concentrations of most detected metals in the Industrial Area surface waters at the Solar Ponds. The Solar Ponds area generally exhibited the greatest concentrations of radionuclides in the Industrial Area. The Upper South Walnut Creek area had the greatest concentrations of volatile organics at the site.

Some of the 98 locations sampled for the 1990 study were within or along the Industrial Area boundaries. The results of the 1990 study indicated that the most serious sources of contamination at the site are the Solar Ponds and that organic contamination in RFP

TABLE 8-1
Industrial Area IM/IRA/DD
Potential Sources of Contamination Contributing to Surface Water Drainage Pathways

Drainage Pathway	Bldgs	IHSSs	Possible Contaminants Associated with IHSSs	PCB Sites	Under-Building Contamination
Drainage Pathway # 1					
	122	116.1	oil, solvents, HCs, low-level rads	Site 5	122
	123	116.2	U, UO_2, carbon tetrachloride, HNO_3, chlorinated hydrocarbon-HCs solvents, Be	Site 7	123
	124	117.3	oil contaminated with U	Site 8	125
	125	120.1	polyester resin peroxide catalyst materials, solvents, Pu, U, Am	Site 9	441
	221	120.2	solvents, resins, Pu, U	Site 12	442
	224	121	U238, U235, Cr(+6), Be, Fe, iodine, Pu, NO2, acids, bases, phosphate, tritium	Site 13	
	275	122	NO_2 and radionuclides	Site 14	
	439	129	fuel oil, diesel, compressor oil, solvents, 1,1,1-TCA, Hg, Cd, Cu, Pb	Site 15	
	440				
	441	136.1	acidic or lithium dichromate, lithium chromate, Cr(+6), depleted U	Site 16	
	442	136.2	acidic or lithium dichromate, lithium chromate, Cr(+6), depleted U	Site 17	
	443	147.2	Be, U	Site 18	
	444	148	NO_2-bearing wastes and low level radioactive waste with NO_2	Site 36	
	445	152	No. 6 fuel oil		
	447	157.1	U (depleted and enriched), Be, solvents		
		157.2	U, Be, chlorinated hydrocarbon solvents, carbon tetrachloride, hydraulic oil, lithium, chromium, Pu		
	452	160	U, Pu, PCBs, PCE, CS_2, TCE		
	463	161	Am, Pu, U, oil, PCE, VOCs		

TABLE 8-1
Industrial Area IM/IRA/DD
Potential Sources of Contamination Contributing to Surface Water Drainage Pathways

Drainage Pathway	Bldgs	IHSSs	Possible Contaminants Associated with IHSSs	PCB Sites	Under-Building Contamination
Drainage Pathway #1 (cont'd.)					
	662	162	VOCs, radionuclides, Be, Fe, Cr, nitric acid, HCl, fluoride		
	663	164.1	Pu		
	664	164.2	U		
	668	164.3	U		
	865	177.0	waste oils, paint, point solvents, low-level radioactive waste		
	866	178	waste oil containing VOCs and low-level radioactive waste		
	880	179	waste oil, chlorinated solvents, Be		
		180	waste oils with contaminated solvents, U		
	883	182	waste oils, chlorinated solvents, Be, UO_2 (depleted)		
	884	187	sulfuric acid, lime		
	886	189	nitric acid, sodium bicarbonate		
	888	190	sodium hydroxide		
	889	191	hydrogen peroxide		
		193	low concentration of amines		
		204	U		
		205	nitric acid, hydrofluoric acid, ammonium salts		
		207	Acids – HPO_4, H_2SO_4, CrO_3 (chromium trioxide), with CN, Cd, Cr, Pb, Ag, As, U, Am, H_3		

TABLE 8-1
Industrial Area IM/IRA/DD
Potential Sources of Contamination Contributing to Surface Water Drainage Pathways

Drainage Pathway	Bldgs	IHSSs	Possible Contaminants Associated with IHSSs	PCB Sites	Under-Building Contamination
Drainage Pathway # 1 (cont'd.)					
		208	Nitric acid with Ag, sodium fluoride, sodium fluoride solution, plating acids (HCl, HNO_3, HF) with plating solution, Cd, CN, nickel sulfate, developer, fixer		
		211	Not available		
		213	ponderete, nitrate, low-level radiation, VOCs		
		217	Not available		
Drainage Pathway # 2					
	223	117.1	U		
	333				
	334				
	549	117.2	radioactivity	Site 3	776
	551	118.2	carbon tetrachloride, organic solvents	Site 10	777
	552	121	U238, U235, Cr(+6), Be, Fe, iodine, Pu, NO_2, acids, bases, phosphate, tritium	Site 11	778
	553	123.1	U solvents, oils, Be, nitric acid, hydrochloric acid, fluoride	Site 24	991
	554	123.1	U solvents, oils, Be, nitric acid, hydrochloric acid, fluoride	Site 25	
	555	123.2	U, solvents, oil, Be, nitric acid, hydrochloric acid, fluoride	Site 26	
	558	147.1	NO_2, U, Pu, Be, acids, solvents	Site 30	
	559				
	561	150.4	Pu		

TABLE 8-1
Industrial Area IM/IRA/DD
Potential Sources of Contamination Contributing to Surface Water Drainage Pathways

Drainage Pathway	Bldgs	IHSSs	Possible Contaminants Associated with IHSSs	PCB Sites	Under-Building Contamination
Drainage Pathway #2 (cont'd.)					
	564				
	707	150.5	Not available		
	708	150.7	Pu		
	750	157.2	U, Be, chlorinated hydrocarbon solvents – carbon tetrachloride, oil, chromium		
	776	158	low-level U		
	777	169	hydrogen peroxide		
	778	172	carbon tetrachloride, oil, TCE, U, Pu		
	965	173	acetone PCE, TCA, radionuclides		
	968	175	waste oils, thinners, metals, radionuclides		
	980	184	radionuclides		
	984	185	1,1,1-TCA		
	985	192	ethylene glycol		
	987	194	not available		
	988	197	PCBs		
	989	210	waste oil, solvents, paints, thinner, grease, gasoline, diesel, fiberglass resins and catalysts		
	990	214	pondcrete, low-level radioactive and hazardous wastes		
	991				
	993				

TABLE 8-1
Industrial Area IM/IRA/DD
Potential Sources of Contamination Contributing to Surface Water Drainage Pathways

Drainage Pathway	Bldgs	IHSSs	Possible Contaminants Associated with IHSSs	PCB Sites	Under-Building Contamination
Drainage Pathway #2 (cont'd.)					
	995				
	996				
Drainage Pathway # 3					
	111	117.1	U	Site 4	None
	112	118.1	carbon tetrachloride or TCE	Site 6	
	113	121	U238, U235, Pu, NO_3, acids, bases, CR(+6), Be, Fe, iodine, phosphate, tritium	Site 20	
	115	124.1	nitrates, Pu, U	Site 21	
	119	126.1	nitrates, Pu, U, organics, inorganics	Site 22	
	127	126.2	nitrates, Pu, U, organics, inorganics	Site 23	
	128	127	nitrates, Pu	Site 24	
	262	131	Pu, U	Site 28	
	331	132	radionuclides, detergent	Site 31	
	333				
	334	134	lithium, Na, Ca, solvents, graphite, Mg	Site 33	
	335	135	tritium	Site 34	
	367	137	chromates		
	371	139.1N, 139.1S	NaOH, KOH, Cr, alpha (radionuclides), HCl, HF, HNO_3, H_2SO_4		
	373	139.2	hydrofluoric acid		

TABLE 8-1
Industrial Area IM/IRA/DD
Potential Sources of Contamination Contributing to Surface Water Drainage Pathways

Drainage Pathway	Bldgs	IHSSs	Possible Contaminants Associated with IHSSs	PCB Sites	Under-Building Contamination
Drainage Pathway #3 (cont'd.)					
	374	144	radioactivity		
	376	146.1	Pu, U, acids, caustics		
	516				
	517	150.2	Pu		
	518	150.3	radioactivity, nitrates, chemicals		
	551	150.3	radioactivity, nitrates, other chemicals		
	559	150.5	Not available		
	561	150.7	Pu		
	701	151	diesel fuel		
	712	156.1	radioactivity		
	713	159	radioactivity		
	770	163.2	radioactivity		
	771	170	waste oils, spent solvents		
	774	171	diesel fuel, gasoline and combustion products, Mg, waste solvents		
	776	172	carbon tetrachloride, oils, TCE, U, Pu		
	777	174	waste paints and thinner, freon-based or oil-based coolant, metals, NO_2, radionuclides		
	778	181	oils, solvents, coolants, low-level radionuclides		
	790	186	uranium nitrate, Pu, Am, Cl, SO_4, oakite		
		188	nitric acid, hydrochloric acid, heavy metals		

TABLE 8-1
Industrial Area IM/IRA/DD
Potential Sources of Contamination Contributing to Surface Water Drainage Pathways

Drainage Pathway	Bldgs	IHSSs	Possible Contaminants Associated with IHSSs	PCB Sites	Under-Building Contamination
Drainage Pathway #3 (cont'd.)					
		206	tritium		
		212	Not available		
Drainage Pathway # 4					
	130				
	131	None	Not applicable	None	None
Drainage Pathway # 5					
	440	116.1	oil, solvents, hydrocarbons, low-level radionuclides	Site 9	440
	447	121	U238, U235, Cr(+6), Be, Fe, iodine, Pu, NO_2, acids, bases, phosphate, tritium	Site 17	447
	448				
	451				
	460	136.1	acidic or lithium dichromate, lithium chromate, Cr(+6), U	Site 18	881
	850	147.2	Be, U	Site 19	883
	881	157.2	U, Be, chlorinated hydrocarbon solvents, carbon tetrachloride, oils, lithium, chromium, Pu		887
	883	161	Am, Pu, U, oil, PCE, VOCs		
	885	164.1	Pu		
	887	177	waste oils, paint and paint solvents, low-level radionuclides		
		178	waste oil containing VOCs and other hazardous wastes, low-level radioactivity		
		204	U		

TABLE 8-1
Industrial Area IM/IRA/DD
Potential Sources of Contamination Contributing to Surface Water Drainage Pathways

Drainage Pathway	Bldgs	IHSSs	Possible Contaminants Associated with IHSSs	PCB Sites	Under-Building Contamination
Drainage Pathway # 5 (cont'd.)					
		205	nitric acid, hydrofluoric acid, ammonium salts		
		208	nitric acid, Ag, sodium fluoride, sodium fluoride solution, HCl, nitric acid, hydrofluoric acid, Cr, Cd-CN solution, nickel sulfate, developer and fixer		
		217	NA		
Drainage Pathway # 6					
	964	101	Liquids and sludges: Pu, Am, tritium, U, Be, Cd, Cr, Ni, nitrates; soil: metals, K, Na, Mg, radionuclides; groundwater: nitrates and radionulides; seeps: NO_2, metals, rads, organics	None	None
		176	mineral spirits, waste oil, VOCs, metals, low-level radioactivity, nitrates		
Drainage Pathway #7					
	207	101	Liquids and sludges: Pu, Am, tritium, U, Be, Cd, Cr, Ni, nitrates; soil: metals, K, Na, Mg, radionuclides; groundwater: nitrates and radionulides; seeps: NO_2, metals, rads, organics	Site 29	779
	215	121	OPWL (see earlier Pathway # 1)		
	705	138	Cr, radionuclides		
	706	144	radionuclides		
	729	150.6	radionuclides, oil		
	777				
	779	150.8	radionuclides		
	782	163.1	radionuclides		
	788				

TABLE 8-1
Industrial Area IM/IRA/DD
Potential Sources of Contamination Contributing to Surface Water Drainage Pathways

Drainage Pathway	Bldgs	IHSSs	Possible Contaminants Associated with IHSSs	PCB Sites	Under-Building Contamination
Drainage Pathway #7					
	928				
	966				

surface waters appears to be limited to seeps where contaminated groundwater discharges. Such seeps in the Industrial Area were identified in the 903 Pad and Lip area and the Mound area of OU2 (Figures 4-1 and 4-2).

Storm water flow was addressed in the Event-Related Surface Water Monitoring Report for 1991 and 1992 (EG&G 1993m), which included evaluation of constituent fate and transport. Findings of the report were presented in Section 5.3.2. Relative to the conceptual site model, the findings showed that contaminants are migrating in runoff from impervious areas within the Industrial Area and that contaminant concentrations decrease with increasing stream discharge along drainage pathways.

Recommendations for surface water monitoring of the Industrial Area were made in Section 5.7. Continued monitoring at Industrial Area surface water sampling locations where elevated concentrations of constituents have been identified will allow monitoring of current releases and assist in the identification of releases from unplanned events in the Industrial Area. The establishment of additional surface water sampling locations at seeps, areas of drainage base flow, and subbasin boundaries and use of OU characterization data as it becomes available will allow better identification of existing contaminant transport pathways in the Industrial Area and will aid in the prevention of contaminant migration in an unplanned event. The establishment of baseline quality conditions for the COPC list will assist in source delineation along the various drainage pathways.

Furthermore, a permanent, automated, fixed station monitoring network to collect information for regulatory compliance and overall RFP surface water management is planned by the Surface Water Division. A real-time telemetry system is also planned as part of the surface water monitoring program. Current measurement capabilities of the real-time system include basic flow parameters (precipitation, flow rate, and water level) and water quality parameters (pH, temperature, dissolved oxygen, specific conductance, redox, salinity, and turbidity). Thirteen stations measure flow and water level, including

GS13 near the Industrial Area boundary (Figure 5-1). The system is planned to include additional stations and analyses for VOCs, metals, and other chemical constituents.

8.3.3 Air

Air was identified as either a primary or secondary transport medium in the conceptual site model. Contaminants may be released to the ambient atmosphere through volatilization or entrainment of contaminated soil, migration of sediment as fugitive dust, volatilization of contaminants from surface water, or release of routine effluents at process building exhaust stacks and ventilation systems.

8.3.3.1 Summary of Existing Monitoring

The RFP air monitoring programs address continuous stack effluents, gaseous effluents, and ambient air monitoring of radioactive and nonradioactive particulates. The four subprograms of the RFP air monitoring system are radiological effluent emissions, nonradiological effluent emissions, radiological ambient monitoring, and nonradiological ambient monitoring.

Radiological emissions monitoring includes periodic confirmation of low emissions, which is currently performed at 54 ducts and vents at buildings in the Industrial Area. The radiological particulate monitoring and sampling program consists of SAAMs, TLLA, and TLLB particle screening of routine air duct effluent sample filters, and radiochemical analysis of isotopes collected from air duct effluent samples. Tritium is the only radioactive gas that is routinely monitored in the Industrial Area.

OU-specific monitoring is conducted, if applicable, during environmental investigations at OUs at RFP. Such monitoring occurred at OU1 and has been initiated at OU5 and OU3. ComRad is another monitoring program in place at RFP. Monitoring stations are located in nearby communities and each is equipped with a radioactive particulate

sampler, a gamma detector, a thermoluminescent dosimeter, and a meteorological monitor. Analyses are performed by EPA.

Meteorological monitoring is conducted at RFP to aid in assessing contaminant transport, diffusion, and deposition. Real-time data are collected at a location in the west buffer zone.

Other air monitoring-related activities include the TRAC dispersion model and a real-time emergency response system, ARAC, which is designed to assess the potential impacts of a radioactive material release to the air. Both of these systems are available for use in emergency response situations. APENs reporting for all potential sources of air pollutants is conducted annually and estimates emissions from all construction activities, building process activities, or any other potential sources that might affect air quality.

8.3.3.2 Comparison of Existing Sample Locations With Potential Transport Pathways

Radiological particulate monitoring includes real-time monitoring of alpha activity at 39 SAAMs that are located within some work areas, but primarily downstream of HEPA filter plenums in buildings where fabrication and recovery operations formerly occurred. The alarms are part of the safety engineering design. They do not provide quantitative data but initiate audible and visible alarms in the event of control system failure. The RFP fabrication and recovery operations have stopped, reducing the likelihood of atmospheric release from this former potential source. Sources contributing to an atmospheric release may be a result of residual material remaining in building stacks or ventilation systems, or the result of waste handling activities.

Additional radiological particulate monitoring is conducted at 130 in-stack samplers. This activity involves TLLA and TLLB radioactivity screening of routine particulates collected in emission samplers in air exhaust ducts at buildings in the Industrial Area.

Biweekly sample filters from continuous routine air sampling of effluents are collected biweekly and screened for TLLA and TLLB. Monthly composites of screened samples are also analyzed radiochemically to obtain a more sensitive measurement of possible radioactive isotopes in duct effluents. Tritium is monitored at six air ducts in the Industrial Area where it has historically been detected. Again, because routine operations have stopped at RFP and because of the engineering controls in place, the likelihood of a release from the former sources associated with routine building operations has decreased.

Nonradiological particulate emission monitoring is performed for beryllium using the 63 filters from stack samplers collected for radioisotope analysis. Because beryllium operations have stopped and are not expected to resume at RFP, routine filter analysis for beryllium may eventually be discontinued or frequency of analysis decreased.

Currently, volatile emissions are not monitored in the Industrial Area. Regulatory reporting uses estimates from chemical inventories and quantities used for APENs submitted to CDH. Sources of volatile emissions other than those specifically identified in the conceptual site model include painting and maintenance operations, and vehicle emissions.

Radioactive ambient air monitoring includes continuous sampling at 47 locations at RFP and in nearby communities. Twenty-two samplers are located in the Industrial Area (Figure 6-2). Future changes to this system are planned. Table 6-1 listed existing and proposed sampling locations.

Nonradiological ambient monitoring for TSP and PM-10 is conducted at the one nonradiological particulate air sampling location. Sampling is conducted according to an EPA sampling schedule of a day of sampling every sixth day. CDH operates three ambient air monitoring stations east and southeast of the Industrial Area that monitor VOC concentrations. CDH also operates samplers designed to monitor for radiological

particulates and metals. These samplers are described in Section 6.0 and shown in Figures 6-1 and 6-2. Sample points were shown in Figure 6-1.

8.3.3.3 Comparison of Monitoring Analyses With Constituents of Potential Concern

In-stack SAAMs detect plutonium-239/240, which is identified as a COPC in Appendix 3.2. The SAAMs do not provide quantitative data but initiate visible and audible alarms based on established plant operating alert levels.

TLLA is the principal radiation associated with air effluents at RFP and is an indicator of effluent quality and the performance of the HEPA filtration system. This indicator is not identified as a COPC in Appendix 3.2. Radiochemical analysis of monthly composite samples is completed for plutonium-238, plutonium-239/240, uranium-233/234, uranium-238, and americium-241. All of these isotopes are listed as COPCs in Appendix 3.2. Gaseous tritium and beryllium are included in the list of COPCs for the Industrial Area.

A number of COPCs identified in Appendix 3.2 are not monitored in the current air monitoring system. These include several metals and radionuclides as well as selected VOCs, SVOCs, and pesticides (Appendix 3.2). Recommendations for the air monitoring program were provided in Section 6.0.

The RAAMP filter samples are collected biweekly and composited by location. Monthly isotopic analyses are performed for plutonium-239/240, which is a COPC.

8.3.3.4 Summary of Relationship to the Conceptual Site Model

Sources of airborne contaminants in the Industrial Area may include historically contaminated areas such as IHSSs or PCB sites that have surface soil contamination or VOCs in the vadose zone and building exhaust stacks and ventilation systems.

Contaminants may be released as fugitive dust from vehicular traffic or as a result of soil particle entrainment during occurrences of high winds. Contaminants may also be released directly to the atmosphere with volatilization from soils or with building effluents. Chemical classes that may be released from sources in the Industrial Area include organic solvents, pesticides, inorganics, and radioactive particles.

Ventilation/filtration exhaust systems in place at all production and research facilities control atmospheric releases from buildings in the Industrial Area. Radioactive and nonradioactive particles are contained by glovebox and filter plenum systems. Chemical emissions are controlled by scrubbers and filters. These and other types of engineering design controls eliminate the concern for airborne transport of contaminants from interior building sources.

Existing monitoring and recommended inclusion of additional baseline constituent determination monitoring will adequately monitor any potential atmospheric releases from the Industrial Area. In addition, the PPCD, developed to monitor windblown constituents that might be released during activities at RFP, particularly OU-specific environmental investigations, will ensure that releases are controlled during ongoing remedial or D&D activities. The plan establishes control measures to mitigate dust emissions and a monitoring program that evaluates the effectiveness of such measures. The PPCD will help prevent unplanned emissions from the Industrial Area by providing early detection of releases to the atmosphere and implementation of control measures.

8.3.4 Incidental and Foundation Drain Waters

The primary source of incidental water is storm water. However, incidental waters may originate from a number of source areas:

- excavation sites, pits, trenches, or ditches;

- water collected in secondary containments or berms, process waste valve vaults, electrical vaults, steam pits, other utility pits, telephone manholes, and fire suppression system discharges; and

- the natural collection of precipitation and storm water runoff in excavations, pits, trenches, ditches, depressions, or other areas that do not intercept the water table.

Incidental waters may also originate from groundwater that collects in building foundation drains and building sumps. Buildings in the Industrial Area may contain foundation drains, sumps, valve vaults, and other structures that intersect the groundwater table. More specifically, incidental waters may occur at 90 nonstorm water discharge locations at RFP (including 19 building foundation drains and building sumps and 71 utility pits) and within 20 valve vaults in the Industrial Area (Hayes 1993; Engineering drawing #37810-057, Process Liquid Waste Collection and Transfer System RCRA Permitted Unit #40 1987).

Incidental waters may be a primary source of contamination to the groundwater, allowing transportation of contaminants from discharges and overflows or groundwater recharge at the foundation drain location. The waters could potentially become contaminated from flow contact with groundwater or groundwater recharge at historical release areas, past waste disposal sites, UBC locations, or from overflows from an unplanned event inside a building.

8.3.4.1 Summary of Existing Monitoring

Management or monitoring programs that are associated with incidental waters include the surface water and storm water programs and the program presented in *CDIW* (EG&G 1993y). The latter program does not include management of foundation drain or building sump waters.

Most known foundation drain flows are monitored before reaching the RFP drainage ponds.

Incidental water locations identified in Table 7-1 were sampled from May 1990 through September 1993 as part of the surface water management program. This monitoring effort was performed at selected locations in the Industrial Area where precipitation collected. These locations include areas inside berms and manholes, around pads, at construction sites, and numerous other locations. Sampling of such areas in 1994 will be included as part of the CDIW report for 1994.

Quarterly sampling was completed under the surface water program in 1992 and 1993 for incidental waters from foundation drains in Buildings 444, 460 (444-460), 774 (774-1), 371 (371-3 and 371-composite), and 779 (779-1), and from building sumps in Buildings 111 (111-2), 707 (707-2), 865 (865-1), and 883 (883-1). The data are being evaluated as part of the OU8 project. Sampling will continue at some locations in 1994, according to program needs.

Aperiodic sampling of foundation drains and building sumps in the Industrial Area for the entire analyte suite was conducted in 1992 and 1993, focusing on foundation drain waters (Hayes 1993). Foundation drains in Buildings 111, 371, 444, 559/561, 707, 771, 774, 883, 886, and 910 and building sumps in Buildings 707, 865, and 883 were sampled. Selected results were provided in Table 7-2. The aperiodic sampling is not an ongoing activity.

Incidental water that accumulates on the ground surface in areas with known contamination (e.g., IHSSs) is collected and analyzed as part of the CDIW.

8.3.4.2 Comparison of Existing Sample Locations With Potential Transport Pathways

Figure 7-1 indicated locations of foundation drains, sumps, vaults, and pits in buildings in the Industrial Area that may allow contaminant transport in incidental waters. Most of the foundation drains discharge into storm drains or at outfalls located along surface water drainage pathways. Table 7-5 listed the location of drain outfalls and foundation drains most likely to be associated with potential sources of contamination. Flow paths for each building foundation drain in the Industrial Area were identified in Table 5-24 and in Figures A-1 through A-14 in Appendix 7.1.

The building outfalls listed in Table 7-5 were evaluated to identify the surface water drainage pathway that may be affected by outfall discharges, possibly allowing contaminant transport. Buildings 883 is located along Pathway 1. Pathway 2 receives flow from the Building 707 foundation drains. The outfalls of Buildings 111, 371/374, 517/518, 554/501, 771, 774, and 740 flow to Pathway 3. Pathway 5 may receive contaminated flow from outfalls from Buildings 444/460, 447, and 850. Building 779 foundation drain waters may be routed to the ITS in surface water Pathway 7. Seven foundation drain outfall locations are not field-verified, and the potential surface water contaminant transport association cannot be made at this time. Drainage from the 559/561 foundation drain is routed to the STP. Building 881 foundation drain water is treated with OU1 treatment activities. The drains in Buildings 865 and 886 enter manholes or sumps near the respective buildings and are collected and transported by truck to Building 374 for treatment.

Surface water drainage pathways that may be affected by foundation drain outfalls include Pathways 1, 2, 3, 5, and 7. Sampling locations are located along all of these pathways, although they may not be close to the outfall location. Sampling of surface drainages and surface water transport pathways were discussed in Section 8.3.2.2.

Groundwater monitoring should also be considered in assessing whether releases from incidental water sources are adequately monitored. Existing monitoring in areas of UBC is limited. Quarterly samples are collected from more than 90 wells in the Industrial Area and are analyzed for the constituents identified in Table 4-4. Groundwater sampling and groundwater transport pathway sampling were discussed in Section 8.3.1.2.

8.3.4.3 Comparison of Monitoring Analyses With Constituents of Potential Concern

Incidental water samples collected during the May 1990 through September 1993 sampling effort were analyzed for pH, nitrates, gross alpha, and gross beta. As noted above, this sampling effort will continue under the CDIW. Incidental water that collects on the ground surface in areas with known contamination, such as the IHSSs, is also analyzed according to the CDIW. The CDIW does not include monitoring of foundation drain waters.

The CDIW requires testing for determination of disposition of collected incidental waters. Established limits exist for gross alpha, gross beta, pH, nitrates, and conductivity. All of these analytes are included in the list of COPCs for surface water provided in Appendix 3.1. However, many of the surface water COPCs are not included in the CDIW analyses. These COPCs include the TAL and non-TAL metals, other inorganics, TSS and TDS indicators, anions, and TCL volatiles.

Because the incidental waters may affect groundwater, the CDIW analytes were also compared with the groundwater COPCs listed in Appendix 3.1. All of the CDIW analytes are included in the groundwater as COPCs. The TAL and non-TAL metals, other inorganics, TSS and TDS indicators, anions, TCL volatiles, TCL semivolatiles, TCL pesticides, and TCL PCBs are groundwater COPCs that are not addressed in the CDIW.

Quarterly samples collected at foundation drains were analyzed for gross alpha, gross beta, tritium, nitrate, pH, conductivity, TDS, TAL metals, volatiles, and semivolatiles. Analyses of quarterly samples collected at building sumps were similar to those for the quarterly foundation drain samples.

8.3.4.4 Summary of Relationship to the Conceptual Site Model

Results of aperiodic sampling of foundation drains and building sumps presented in Table 7-2 indicate that the incidental waters from the sampled sumps and foundation drains contain some contamination, confirming the likelihood of contaminant migration in incidental waters from these sources. Incidental waters occurring at excavation sites, pits, trenches, or ditches or collected in secondary containments or berms may become contaminated if they occur in historically contaminated areas such as IHSSs or PCB sites where soil contaminants may leach into the collected water. Incidental waters that collect in process waste valve vaults, electrical vaults, steam pits, other utility pits, telephone manholes, building foundation drains, and building sumps may become contaminated from groundwater recharge or from flow contact with contaminated groundwater in areas where groundwater contamination exists. An unplanned event such as a fire, spill, leak, or overflow could also lead to contamination of incidental waters.

The Surface Water Division's flow diagrams for the management and disposition of foundation drain and utility pit discharges were presented in Figures 7-4 and 7-5. The diagrams generally indicate flow routing of incidental waters from foundation drain and utility pit discharges. In some cases, water is routed to the STP, Building 374, or other locations for treatment, thereby eliminating the concern for contaminant transport in those incidental waters. More often, incidental waters discharge at outfalls in or near the Industrial Area. These discharges may flow to one of the surface water drainage pathways (Table 5-24), possibly contaminating soils in the area or reinfiltrating through the soil to the upper hydrostratigraphic unit.

Recommendations made in Section 7.8 will allow better identification of transport pathways associated with incidental waters in the Industrial Area. Enhancements to current surface water and groundwater monitoring programs recommended in this IM/IRA/DD and use of OU characterization data will also improve the assessment of potential migration pathways from foundation drains and building sumps. Expansion of the CDIW sampling program to include more sampling locations and analytes as suggested in earlier sections will allow more adequate detection of releases associated with incidental waters in the Industrial Area.

9.0 DECONTAMINATION AND DECOMMISSIONING ACTIVITIES MONITORING RECOMMENDATIONS

The objectives of this section of the IM/IRA/DD are to establish techniques for protection of environmental pathways in the vicinity of future D&D activities and to identify monitoring to assure releases are detected and proper response provided. The development of methodologies for these controls began by acquiring and reviewing information on the (1) D&D planning process, (2) monitoring technologies available, (3) pathway protection approaches, and (4) emergency response capabilities. Subject matter experts at RFP and other selected DOE facility personnel were identified and interviewed, and pertinent information was reviewed. The following documents were reviewed to prepare this section:

- *RFP Mission Transition Program Management Plan* (EG&G 1992a);
- *Rocky Flats Plant Transition Status Report* (EG&G 1993uuss);
- *Decontamination and Decommissioning Guidance Document, Draft 3* (DOE 1994); and
- *Rocky Flats Emergency Plan* (EG&G 1993w).

Complete references are provided in Section 12.0.

9.1 DESCRIPTION OF DECONTAMINATION AND DECOMMISSIONING ACTIVITIES

The DOE D&D process is the sequence of events that occurs in the disposition of surplus DOE facilities. The D&D process should be conducted by the Office of Environmental Restoration (EM-40) in compliance with DOE Order 5920.2A, Chapter V, "Decontamination of Radioactively Contaminated Facilities," September 26, 1988. This

chapter identifies D&D requirements, principal planning documents, and policies; describes responsibilities of DOE Headquarters and field organizations; and provides additional sources of information (DOE 1994).

Detailed written plans for RFP-specific D&D activities currently have not been formulated. In general terms, D&D will entail the removal of fixed materials (including residual COPCs), equipment, and facilities, including buildings. Examples of D&D activities include the following:

- Remove fixed equipment, piping, and tanks.
- Retrofit equipment for future use.
- Dismantle and remove ventilation systems including glove boxes, ducts, and stacks.
- Modify or renovate buildings.
- Dismantle or demolish buildings.
- Perform building construction.
- Excavate underground equipment, piping, and foundations.

While specific details of the D&D process are still under development, the approach will be multiphased and complex. The basic approach to D&D may vary from facility to facility, but it is likely to follow similar tenets regardless of where the facility is in the DOE complex. The D&D process consists of seven basic components or phases. These phases include Transition, Project Preparation, Environmental Review, Engineering and Planning, Decommissioning Operations, Closeout and Verification, and Postoperation Activities (DOE 1994). Table 9-1 summarizes the D&D process and the Industrial Area IM/IRA linkage to this process. The various phases of the D&D process are described in the following text.

9.1.1 Phase I - Transition

Phase I starts with termination of operations, includes the establishment of a surveillance and maintenance program, and ends with the achievement of safe shutdown and transfer

TABLE 9-1
Industrial Area IM/IRA/DD
Phases of Decontamination and Decommissioning at Rocky Flats Plant

Phase I Transition	Phase II Project Preparation	Phase III Environmental Review, Subproject Base-line Development, Facility Characterization	Phase IV D&D Engineering Implementation Planning	Phase V Decommissioning Operations	Phases VI & VII Closeout and Verification; Postoperations Activities
• Limited Operations • Waste Operations and Material Consolidation • Deactivation • Decontamination Ready	• D&D Project Management Plan • Master List of Surplus Facilities • Five-Year Plan • Master D&D Schedule • Master D&D Budget • Activity Data Sheets • Regulatory Oversight Approach • Technology Evaluation & Development • Waste Management Strategies • Release & Disposal Criteria • QA Program Plan • Development of Organizational Interfaces	• Facility Characterization • Safety Analysis Review • Subproject Management Plan • Engineering Alternatives Analysis • Subproject Scope Development • Subproject Base-line Schedule • Work Breakdown Structure • Regulatory Analysis • Environmental Review • Subproject QA Plan • Management Implementation Plan	• Subproject Decommissioning Plan • Engineering Design • Emergency Response Plan • Facility Waste Management Plan • Facility Release and Disposal Criteria • Cost Estimate • NEPA Documentation • Procurement Plan • Site Preparation • O&M Procedures • Training Plan • Contractor Selection	• D&D Operations • Waste Management Operations • Status Reports • Procedure Implementation • QA Audits • Develop and Maintain D&D Database • Contract Management	• Radiological Surveys • Chemical Surveys • Lessons Learned Report • Postclosure Care
		IA IM/IRA Actions	**IA IM/IRA Actions**	**IA IM/IRA Actions**	**IA IM/IRA Actions**
		• Identification of COPCs • Identification of Media-Specific Pathways • Development of Monitoring Criteria	• Design of Verification Monitoring Plan • Installation of Verification Monitors • Establishment of Base-line Conditions	• Verification Monitoring • Performance Reports • Investigation of Detected Contaminants • Response to Detected Releases	• Reestablish Base-line Conditions • Closeout/Completion Report • Monitor Removal

Legend:

D&D = decontamination and decommissioning
QA = quality assurance
COPC = constituents of potential concern
NEPA = National Environmental Policy Act
O&M = operations and maintenance

to EM-40. EM-40's concerns are in requiring preliminary characterization and hazards analysis; establishing an effective surveillance and maintenance program; starting the EM-40 budget cycle (which could be up to three years long); and achieving compliance with the EM-40 acceptance criteria. This phase ends with the execution of a Memorandum of Agreement (MOA) that transfers administration of the site to EM-40 (DOE 1994). The transition process involves removing nonfixed materials, product, equipment, and waste from RFP facilities in preparation for D&D. These activities are unlikely to create a risk of undetected release; therefore, establishing verification monitoring for these activities is not considered necessary. Activities will be performed according to written plans or procedures. Potential releases will be predictable and detectable because the materials being removed will have been thoroughly characterized and hazards assessed. An example of a transition activity is pumping chemicals from a tank into drums, removing the drums from the building, and storing them in an engineered storage area.

Additionally, engineering controls for transition and D&D activities will be installed and relied upon to prevent releases. During transition, because known materials or wastes will be handled under controlled conditions, undetected releases are unlikely. For example, removal of a drum of excess solvent from a building does present a risk of a spill but little risk of an undetected release. The personnel removing the drum will be trained to perform the task and to implement the spill response procedures developed for transition activities. Personal observations and activating the emergency response system are more reliable and timely than use of an automated monitoring and alarm system.

Transition consists of four stages according to the *RFP Transition Plan* (DOE 1992a). The stages are not mutually exclusive; multiple concurrent activities are possible, incorporating aspects of more than one stage.

9.1.1.1 Stage I - Limited Operations or Continued Nonnuclear Production

The ongoing activities in the buildings are those essential to the operation and maintenance of safety and safeguard-related systems. The end of this stage will be governed by the building mission. When a facility is declared to be surplus status, it will be recommended for transition to Stage II.

9.1.1.2 Stage II - Waste Operations and Material Consolidation

This stage of the process begins to shift facilities that have been declared to be surplus status toward deactivation. The characterization, stabilization, packaging, consolidation, removal, and transportation of SNM and other nuclear material, hazardous material, and classified matter are key activities included in this transition stage. The primary objective of this stage is to remove major hazards and reduce overall safety hazards (DOE 1992a).

9.1.1.3 Stage III - Deactivation

The major deactivation tasks are (1) development and implementation of a cleanup plan in accordance with Environmental Restoration and Waste Management criteria and standards, (2) completion of a final building characterization, and (3) development and implementation of effective surveillance programs to ensure the maintenance of appropriate safeguards and environmental systems (DOE 1992a).

9.1.1.4 Stage IV - Decontamination-Ready

A building is considered decontamination-ready when the conditions of the preceding three stages have been satisfied. The following factors, originally listed in the transition plan (DOE 1992a), will be the basis for the criteria to accept the facilities for decontamination:

- The facility has been formally declared to be surplus status for Defense Programs.
- All Defense Program missions have been transferred or addressed.
- Usable equipment has been removed.
- Verification that the following vital safety systems (VSS) function:
  - fire detection and suppression;
  - life, safety, and disaster warning;
  - emergency power;
  - heating, cooling, and ventilation; and
  - radiation monitoring.
- Control systems for the VSS are operational.
- SNM has been removed.
- Classified parts, fixtures, and documents have been removed.
- Hazardous materials and chemicals have been inventoried and removed.
- Physical, chemical, and radiological properties of buildings have been characterized.
- Readily removable contamination has been cleaned up.
- Nonessential equipment has been locked out and tagged out.
- Contaminated equipment and systems have been isolated.
- An environmental compliance assessment has been completed.

- All corrective actions and audit findings have been closed out.

- Historical data on unplanned occurrences at buildings and facilities have been compiled.

- All available drawings, specifications, and procedures have been compiled.

- Existing data from soil, surface water, and groundwater monitoring have been compiled.

- Known environmental assessment requirements have been identified.

- Security systems are operational as required.

- Funding requirements have been identified and requested.

Stage IV of the transition process will be maintained until physical D&D has begun or the building has been designated for other uses.

All work performed at RFP is subject to various administrative controls that are designed to protect (1) health and safety of personnel and the public and (2) the environment. It is anticipated that buildings and remaining equipment will have been well characterized and hazards assessed during transition. This information will be useful for developing the D&D analogs to the Transition Standards Identification Program (TSIP) and Activity Based Planning (ABP) Process Activity Control Envelopes (ACE) described in the transition plan (DOE 1992a).

As stated in the *Activity Control Envelope Development* document (EG&G 1994c), the TSIP was developed by EG&G Rocky Flats for identification and demonstration of compliance with appropriate standards applied in a graded approach. The process focuses on activities rather than on buildings and on necessary standards rather than the

universe of codes and standards. The ACE provides an analysis of a manageable scope of work including a definite start and finish point, a flowchart of process steps, and a hazard assessment. The ACE supports the timely development of a complete work control document(s), and provides the person in charge of the activity and other personnel with a coherent expression of the standards applicable to an activity and their adequacy for safe conduct of the work. Because few buildings have gone through transition, little is known of the specifics of D&D; and work control plans have not been prepared.

9.1.2 Phase II - Project Preparation

Surveillance and maintenance continues during this phase. The principal planning activities are preparing the D&D Project Management Plan and establishing the technical cost and schedule base-lines for the project. The Project Management Plan also establishes the initial position with respect to compliance with environmental statutes and regulations (DOE 1994). For example, the initial DOE position on NEPA and whether an Environmental Impact Statement (EIS) or Environmental Assessment (EA) is to be prepared, shall be stated. Any relationship to CERCLA shall be identified, whether related to D&D directly or to nearby remedial actions dealing with soils and groundwater that may be regulated by CERCLA. An initial position on the applicability of RCRA shall be stated. Consideration should be given to initiating some of the Phase III environmental review during Phase II. This phase would also begin to define waste management strategies, develop a quality assurance program for the work to be done, and define organizational interfaces. This phase ends with the approval of the Project Management Plan.

9.1.3 Phase III - Environmental Review, Subproject Base-line Development, and Facility Characterization

During Phase III, as funding is available, the site and facility are characterized and a safety analysis and risk assessment is completed. Engineering work is performed to

define and estimate the D&D alternatives, and other engineering studies are performed to support the preparation of the appropriate NEPA documentation. The key objective of this phase is to reach a decision that defines the scope and end condition of the D&D project. This objective is performed by developing a subproject scope and a base-line schedule. The subproject WBS is also developed at this time. A regulatory analysis and the Environmental Review Process are begun in this phase. Candidate decommissioning alternatives will be evaluated and selected based on the results of the environmental review (DOE 1988). This phase ends with approval of the D&D alternative and approval to start detailed engineering (DOE 1994).

9.1.4 Phase IV - Decontamination and Decommissioning Engineering and Implementation Planning

When the preferred approach is selected in Phase III and the D&D alternative is approved, preparation of the Subproject Decommissioning Plan can begin. This phase includes the development of the Engineering Design, Emergency Response Plan, Technical Approach, Facility Waste Management Plan, Facility Release and Disposal Criteria, and the Procurement Plan. The latter part of this phase includes acquiring the performing contractor, preparing procedures and manuals, training personnel, and making other necessary preparation by the contractor. This phase ends with the successful completion of the Readiness Review and approval to start decommissioning activities (DOE 1994).

9.1.5 Phase V - Decommissioning Operations

This phase includes the fieldwork to execute the Decommissioning Plan. It ends when the contractor declares he has met contractual requirements. Important components of this phase include the development of status reports, implementation of procedures, conducting QA audits, input and maintenance of a D&D database, and contract management (DOE 1994).

9.1.6 Phase VI - Closeout and Verification

During this phase, the field office prepares or has prepared the close-out documentation and an independent verification contractor, selected by the Headquarters Program Manager, makes the necessary reviews and field checks to verify that the specified end conditions have been met. These activities may include Radiological Surveys, Chemical Surveys, and Lessons Learned Reports. Supporting documentation may be provided by the Industrial Area IM/IRA verification monitoring program personnel. This phase ends with approval of the close-out verification (DOE 1994).

9.1.7 Phase VII - Postoperations Activities

If appropriate for the project, this phase will constitute long-term surveillance and maintenance or other institutional controls to carry out the final disposition decision of the project.

9.1.8 IM/IRA Link to Decontamination and Decommissioning Activities

Relative to this IM/IRA/DD, an important component of D&D verification monitoring is the administrative link between the D&D project and the Industrial Area IM/IRA. This link is important because it is necessary to identify D&D schedules and activities for specific buildings and areas in a time frame sufficient to allow for implementation of Industrial Area IM/IRA actions. The D&D project and the Industrial Area IM/IRA have a programmatic relationship that will facilitate a ready information exchange between the two projects.

Currently, D&D resides as a subproject within the Environmental Restoration Program, which is also home to the Industrial Area IM/IRA. Although much of the D&D planning process remains undeveloped, this Decision Document requires that D&D planning procedures include a component that communicates directly with the Industrial Area IM/IRA management team. This communication is to be done early enough in the

process to allow for proper planning, budgeting, and implementation of the verification monitoring required for the indicated D&D action. This communication will occur throughout the D&D process and will most likely begin in Phase III - Environmental Review, Subproject Base-line Development, and Facility Characterization.

Potential IM/IRA actions that correspond to D&D Phases III through VII, as outlined in Table 9-1, are described in the following subsections.

9.1.8.1 Phase III - IM/IRA Actions

During this phase when the Subproject Scope and Activity Base-line Schedule are developed, the Industrial Area IM/IRA will focus on the planned site-specific D&D activities. When the general D&D activities have been defined, the IM/IRA can be implemented. This process begins with the identification of the COPCs for the building or area undergoing D&D and also identifies media-specific pathways that may require monitoring. Monitoring criteria would be established from this information.

9.1.8.2 Phase IV - IM/IRA Actions

Phase IV of the D&D process, D&D Engineering and Implementation Planning, includes the development of several of the D&D operating plans. These plans include the Waste Management Plan, Emergency Response Plan, and the Technical Baseline. IM/IRA activities corresponding to this D&D phase are the design of the Verification Monitoring Plan, installation of verification monitors, and the establishment of base-line conditions before beginning D&D activities.

9.1.8.3 Phase V - IM/IRA Actions

During the implementation of D&D activities, verification monitoring will be ongoing. The results of this monitoring can be compiled in an annual performance report or, if the activities have shorter durations, included in a Close-out or Completion Report. These

reports will summarize the verification monitoring system and the results of the sampling or monitoring. A summary of actions taken relative to monitoring system detections will also be included. These actions could include emergency or environmental response actions or changes to D&D procedures.

9.1.8.4 Phase VI and VII - IM/IRA Actions

IM/IRA actions relative to the completion of site-specific D&D activities will include the close-out monitoring to reestablish base-line conditions, removal of the verification monitors, and final documentation in the form of a completion report.

9.2 CONCEPTUAL VERIFICATION MONITORING APPROACH

The objective of this document is to provide for the detection of potential releases that are not controlled by engineering controls implemented for D&D activities. The monitoring system to provide this capability will be known as the "verification monitoring system." It should be noted that the emphasis for D&D monitoring will be to protect workers and detect acute releases. Verification monitoring will be implemented to verify the effectiveness of site-specific D&D monitoring. The verification monitoring network will be designed to measure constituents outside the immediate area of D&D activity with emphasis on protection of the environment and general public.

The primary method for detecting and responding to a condition that leads to an environmental release will be the planning of the process and the training of personnel to recognize and report out-of-normal conditions. However, some D&D activities will be performed that could result in a release that would go undetected. Therefore, monitoring systems will be installed before starting D&D activities that present the potential for an undetected release. Existing RFP monitoring systems will also be used in conjunction with the verification monitoring program to detect long-term lower concentration contaminant releases.

An approach for monitoring during D&D should consider the following steps:

- Reduce the listed COPCs to be monitored to those constituents related to a specific building or area.
- Limit the COPC list further based on risk or toxicity screening criteria.
- Identify pathways of potential concern.
- Identify media that will be potentially affected.
- Establish a base-line data set for environmental monitoring.
- Identify engineering controls to prevent releases from affecting the media.
- Implement verification monitoring.

Considerations for D&D planning include the following items:

- Determine the level of the D&D activity. (Is a glove box or is an entire building scheduled for removal?)
- Will activities generate waste or constituents that could affect identified media?
- What is the expected duration of D&D activity?
- Where is the facility or area to be addressed by D&D?
- Will facility operations or other D&D activities be under way nearby?

- Is air dispersion modeling necessary to determine the best placement and density of air monitoring stations?

- Is a review of meteorological data required to plan activities?

- Can existing air and surface water monitoring programs and stations (i.e., RAAMPs, SAAMs, NPDES, and other) be incorporated into the D&D monitoring program?

- Will additional personnel training be required for any planned activities?

- Is interaction with emergency planning and other groups at RFP necessary?

The first action will be to establish the COPCs associated with the planned activity, which will allow for the design of the monitoring system or systems based on the potential release pathway and detectability of the specific constituents.

9.2.1 Basic Methodology for Identifying Constituents of Potential Concern

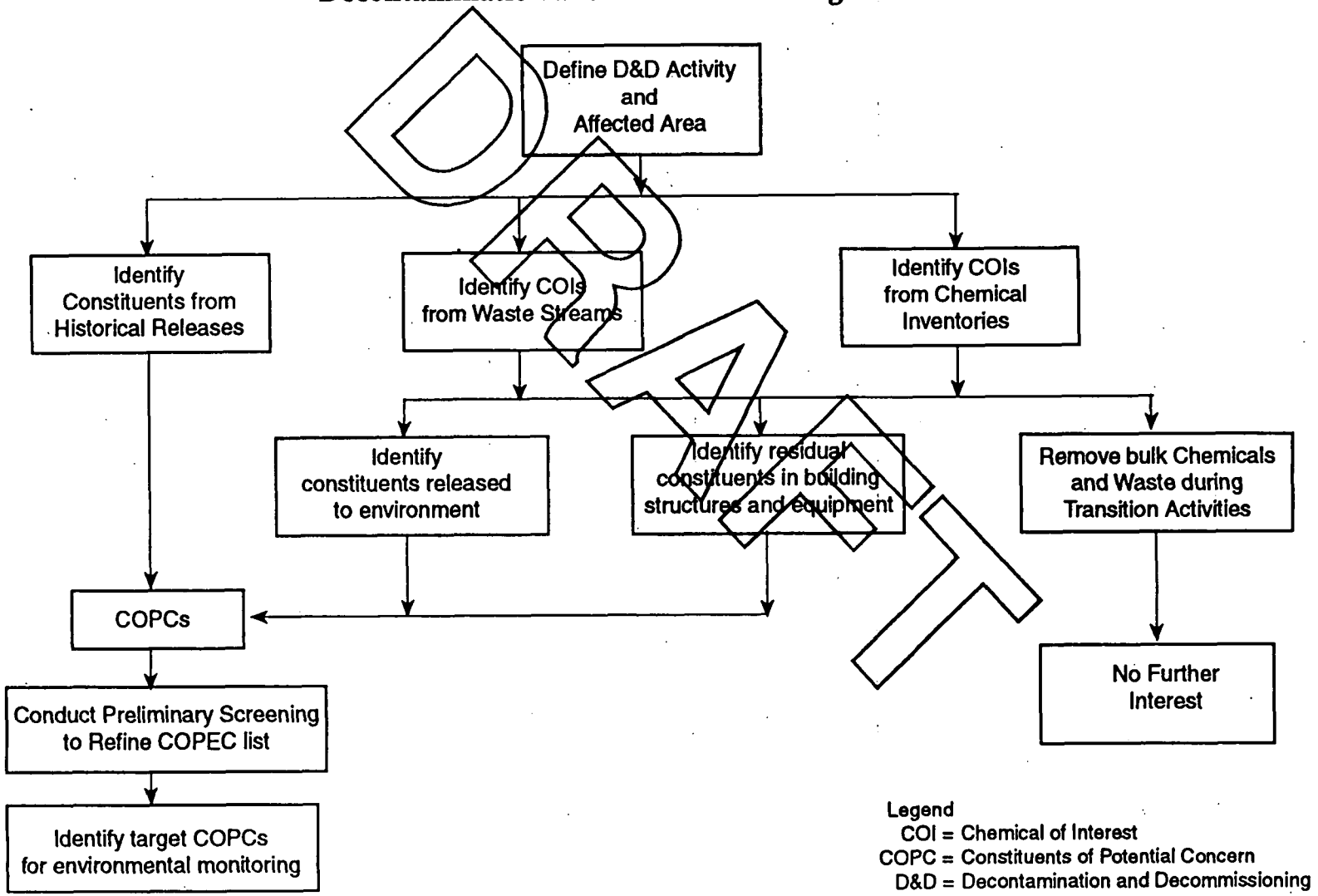
The COPCs that could be considered for the Industrial Area environmental monitoring were identified in Section 3.0. However, as a specific D&D activity is defined, the list of COPCs will be refined to those applicable to the area undergoing the D&D activity. Figure 9-1 is a flow diagram that may be useful when developing a COPC list for D&D.

COPCs for monitoring D&D activities will be identified from the following sources:

- historical releases;

- releases from past management and handling of chemical product inventories and waste streams (These will be identified from building characterization and assessments conducted under the Transition Phase.);

FIGURE 9-1
Industrial Area IM/IRA/DD
Approach to Identifying Constituents of Potential Concern for Decontamination and Decommissioning Activities



Legend
COI = Chemical of Interest
COPC = Constituents of Potential Concern
D&D = Decontamination and Decommissioning

flats\lm-lra\fig9-1.fh3

- residual constituents left in building structures and equipment after the Transition Phase; and

- spills of chemical products and waste streams from disposition during the Transition Phase. The bulk of chemical products and hazardous wastes stored in buildings will be removed during the Transition Phase; therefore, spills from these compounds will not be a factor during D&D.

9.2.1.1 Historical Releases

Historical releases in the affected area will be characterized through the ongoing RFI/RI activities that are being conducted in the Industrial Area. Much of this information is summarized in Appendix 3.3 (IHSS locations), Appendix 3.4 (PCB locations), and Appendix 3.5 (UBC locations). Locations of IHSSs, PCB sites, and UBCs are shown in Figure 3-2.

The RFP OU Managers will be contacted for further details regarding the IHSSs in the affected area and for a current list of COPCs that have been identified from recent sampling. Any overlap between the D&D activities and the ongoing or planned RFI/RI activities will be identified. Overlap between D&D and RFI/RI activities (i.e., monitoring, groundwater sampling, surface water sampling, or decontamination) will be coordinated to minimize sampling or decontamination efforts and costs.

9.2.1.2 Removal of Bulk Chemicals and Waste Streams

Chemical products and waste stored in the affected area will be inventoried and removed during the Transition Phase. Chemicals that are stored in the building or the plant area will be identified using the latest version of the CTCS database. This database was described in Section 3.0 of this document. (See Appendix 3.6 for an example of the types of COIs at each building.)

Hazardous wastes (including containers, tanks, and other units) and their storage areas will be identified using the WEMS and WSRIC databases described in Section 3.0 of this document. A list of the RFP-permitted storage areas, based on data from the WEMs database for December 7, 1993, is presented in Appendix 3.7. This appendix should only be used as an example because the waste storage quantities and contents change frequently. WEMS also contains data regarding satellite accumulation and 90-day storage areas. It is suggested that the most up-to-date version of the WEMS database be used to identify areas that may have been used to manage hazardous wastes.

Use of the CTCS, WEMs, and WSRIC databases will aid in locating waste streams and chemical inventories (for COIs) in the buildings of the affected area for proper disposition during transition. The disposition of the chemicals (i.e., inventory and consolidation of chemical storage in one building or reuse of chemicals at another building) will be conducted under the Transition Phase before D&D begins. The transition plan should detail how the chemicals will be packed and transported to their destination and must comply with applicable regulations for materials handling, transportation, and labeling and container requirements. Because these activities will be handled under the RFP Transition Phase and are not considered D&D activities, they will not be discussed further in this document.

Knowledge of COPCs and COIs identified and removed during transition is important for D&D activity planning. Although chemical products and waste streams will be removed from the affected area, COIs may have been released into the environment in spills during past management of chemicals and waste streams. Residual COIs that may affect D&D activities may remain in building structures and building equipment after the Transition Phase. COIs that could have been released into the environment from spills of chemical product during transition will be handled under the emergency response plans for the building transition. However, spills that resulted from past storage and management of hazardous wastes may be identified during the Transition Phase (e.g., through implementation of a RCRA Closure Plan and, if applicable, subsequent RCRA Corrective Actions). This information will be summarized in the building

characterization and assessment reports that will be prepared in the Transition Phase. Because these COIs may still be in place during D&D, they will be incorporated into the list of COPCs to be considered for D&D activities.

Residual compounds that remain in building structures and building equipment after transition will also be considered COPCs for D&D activities. Residual compounds will be identified from historical information about the building activities and major processes conducted at the building. In addition, the list of types of chemicals and wastes handled and stored in the buildings (from the CTCS and WEMS databases) will aid in determining potential residual COIs. During the Transition Phase, these COPCs will be identified from the building characterization and assessment reports and will be incorporated into the list of COPCs to be considered for D&D activities.

9.2.1.3 Refining the Constituents of Potential Concern List

It may not be necessary to monitor for the entire list of COPCs during D&D activities. Depending on the area or building undergoing D&D, the complete list of COPCs may be unnecessarily lengthy. In such instances, screening methods may be applied to identify a subset of target COPCs for the particular D&D activity. The goal of this screening approach is to reduce the number of COPCs to a shorter, more cost-efficient list for use in environmental monitoring.

The preliminary screening approach includes consideration of historically detected contaminants in and around the building or area; examination of Material Safety Data Sheets (MSDSs) of brand name COIs, availability of EPA toxicity criteria, availability of EPA-approved analytical methods, and the adequacy of the method detection limit; and professional judgment. Figure 9-2 is a flow diagram of the screening process. It is anticipated that the screening process will result in a concise COPC list specific to the area or building undergoing D&D.

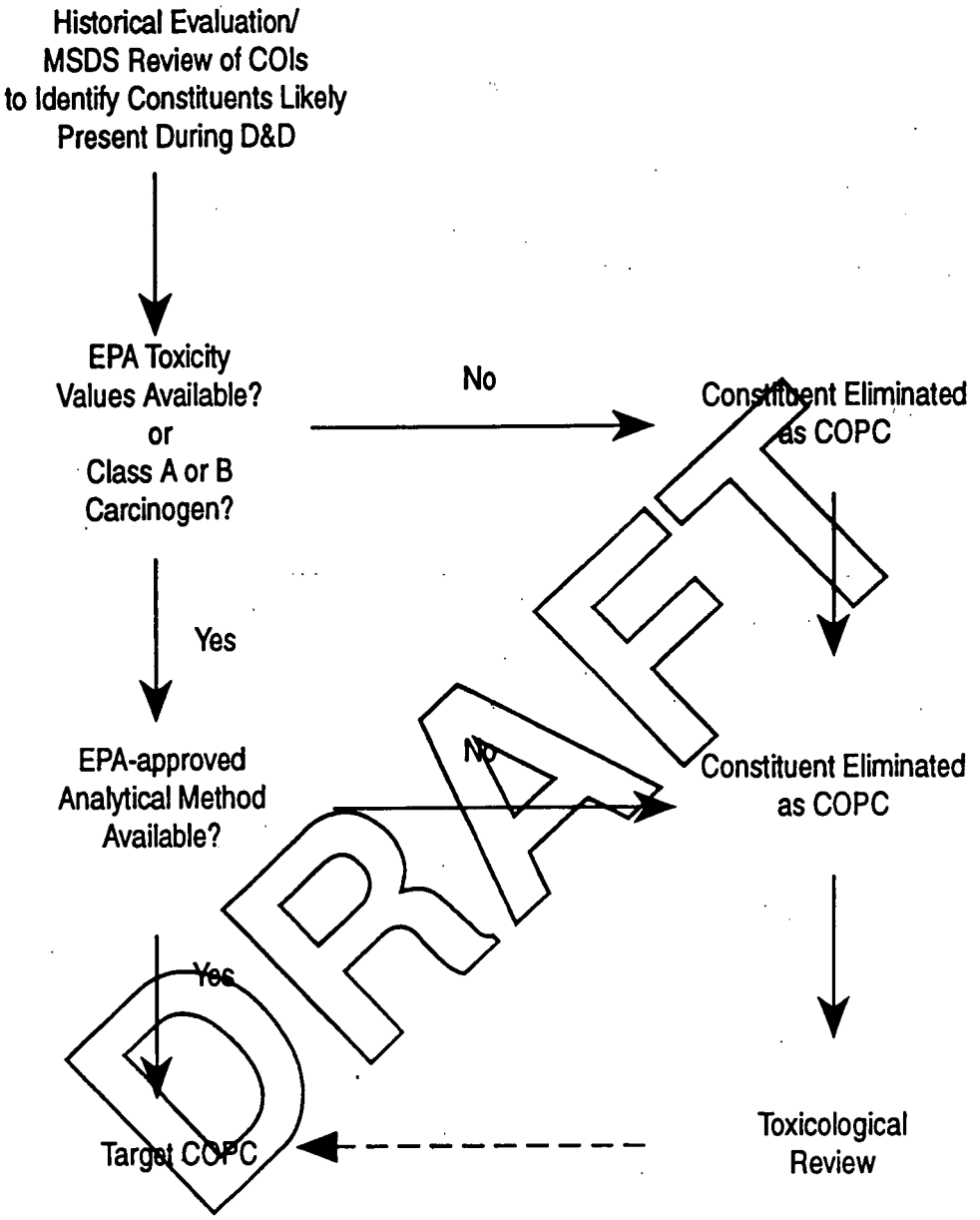


FIGURE 9-2
Industrial Area IM/IRA/DD
Screening Approach to Reduction of COPC List

As indicated in the flow diagram, available characterization data on constituents that have been detected in or around the building or area as well as historical information regarding constituents stored or used there will first be examined. Any brand name COI will be evaluated using MSDSs to determine hazardous or toxic constituents as part of this initial screening step. The chemical identified in the first screening step will then be examined to determine availability of EPA toxicity values, such as carcinogenic slope factors or noncarcinogenic reference does. Current toxicity values, will be obtained from the EPA's Integrated Risk Information System (IRIS) database or current Health Effects Assessment Summary Tables (HEAST). Chemicals without current toxicity values will be eliminated as COPCs unless they are Class A or B carcinogens based on EPA's weight-of-evidence classification system for carcinogenicity.

Chemicals potentially present in the building or area that have current toxicity values or are Class A or B carcinogens will then be screened next under a third step. This screen involves identification of those chemicals that can be adequately detected using EPA-approved analytical methods. Those chemicals that do not have EPA-approved analytical methods will be eliminated as COPCs. This screening step may also include an evaluation of the method detection limit (MDL) to ensure that the MDLs are adequate. This evaluation may involve comparison of the MDL to a calculated preliminary remediation goal (PRG).

A final overview of the screening process will be completed to ensure that constituents were appropriately eliminated. This final step may involve consideration of chemicals that are currently under review by EPA for toxicological study. There may be cases where a chemical's toxicity value has been temporarily removed from the IRIS database because new bioassay or epidemiological data are being evaluated. Chemicals that are known to be particularly toxic, even when no toxicity criteria are available, may be included as COPCs if deemed appropriate. For example, lead is a Class A carcinogen and does not have a current slope factor for quantitative assessment of risk, although other exposure models are available for the assessment of lead exposure. Lead would, therefore, be maintained on the COPC list.

9.2.2 Base-line Data Collection

Data collected from current RFP monitoring networks will be used when compiling base-line data. However, additional monitoring recommended in the media-specific sections of this IM/IRA will be required, in some cases, to collect base-line data for the constituents on the COPC list that are not monitored by the current network. The monitoring shall be initiated before start of the D&D activity. Base-line data are essential to establishing action levels for the verification monitoring. Refer to the media-specific sections for details concerning monitoring recommendations or to Section 11.0 for a summary of recommendations.

9.2.3 Media and Pathway Identification

The media that could potentially be impacted by D&D activities are air, surface water, soil, and groundwater. Section 10.0 is a generalized description of a conceptual site model for D&D activities.

9.2.4 Verification Monitoring

Verification monitoring should consist of real-time measurements, when possible, of general chemical categories and laboratory analysis of grab or composite samples for specific constituents. The verification monitoring program will be designed to target COPCs identified for specific activities. Real-time monitoring has significant detection limitations compared to laboratory analyses, but circumstances do exist where real-time monitoring could be used to detect acute releases. For example, SAAMs (described in Section 6.0) are used to give early warning of alpha contamination within buildings and in air effluent from the RFP buildings where plutonium is handled. The SAAMs will alarm only when there is a major filtration failure, but they have provided successful warning under the rare circumstance when such a failure has occurred. Any indication of an acute release will trigger action by the Rocky Flats emergency system.

Long-term fluctuations in many concentrations of COPCs will be measured using existing surface water, air effluent, and ambient air samplers. These results may be used to (1) verify D&D activity monitoring, (2) identify gaps in monitoring and engineering controls, and (3) identify releases that require a response action. Recommendations for additional monitoring to detect all COPCs were made in Sections 5.0, 6.0, and 7.0. If these recommendations are implemented, short and long duration releases may be detected before they leave the Industrial Area because a base-line data set will be available for comparison.

The level of D&D activities will determine the type of instruments selected and the sampling and analysis scheme required that best fit the D&D activities (i.e., real-time and composite instruments, and detection capabilities/levels). Specific recommendations for verification monitoring are provided in Section 9.5.

9.3 PATHWAY PROTECTION

Before discussing pathway protection, it is important to note that facility characterization, hazard assessment, and removal of nonfixed contamination and excess chemicals from the buildings during transition will reduce the potential for release during D&D. Information from facility characterization will be used when developing work packages for D&D activities. Work packages will be reviewed by personnel from the RFP Environmental Protection Management group. Identification of potential sources, pathways, and pathway protection requirements will be included in each activity work package. Methods of protecting pathways may be a physical engineering control, a set of procedures that prevents release, or a combination of physical and procedural controls.

The media of concern are air, surface water, groundwater, and soil. Pathways to surface water and groundwater include foundation drains, sumps, sewer lines, other piping including process lines, cracks in foundations and walls, and releases outside buildings during cleaning or chemical handling activities. Potential pathways to the air, surface water, and soil include stacks or vents, releases from contaminated equipment during

removal from fixed locations, suspension of contaminated soils, and release of fugitive dust.

The primary method for preventing releases through the pathways described in the previous paragraph involves early pathway identification and elimination of the pathway. Possible examples of pathway elimination include the following engineering controls: (1) seal off all unnecessary pipes, and process and sewer lines; (2) ensure maintenance of ventilation system; (3) decontaminate equipment, tanks, and materials within buildings before removal; (4) control soil and dust suspension; (5) stop activity when weather conditions reach a predetermined threshold level; and (6) cover soil, drains, vaults, ditches, etc., with impermeable and bermed control structures.

A specific pathway protection method could involve extending foundation drains with piping to the selected treatment or collection system. This method would assure that groundwater and surface water would be protected if a D&D activity releases contaminants to the foundation drains. Spraying the interior and exterior of buildings and surrounding soils with water during demolition, construction, or other heavy activity would be a control measure for fugitive dust and soil suspension. Another example would be berming to prevent inflow of storm water into an area undergoing D&D and to collect water that has become contaminated when used for dust suppression.

9.4 DECONTAMINATION AND DECOMMISSIONING MONITORING TECHNOLOGIES ASSESSMENT

Extensive monitoring networks exist at RFP. These networks characterize concentrations of constituents for regulatory compliance and for measurement of environmental protection performance. The networks primarily focus on boundary and buffer zone monitoring and are predominantly based on collection of samples for laboratory analysis. This approach achieves state of the art detection levels but is time consuming. The goal of this section is to discuss assessment of monitoring technologies that could be used for air and surface water pathways from D&D activities with an emphasis on real-time

monitoring where possible. Reliability, detection capabilities, applicability to COPCs, portability, commercial availability, and cost must be considered in selecting monitoring systems for D&D.

9.4.1 Monitoring Technologies Assessment Approach

Assessment focused on identifying monitoring technologies available for detection of releases from D&D activities, preferably in realtime. The assessment was initiated by holding discussions with personnel at RFP and other DOE facilities involved in operating and upgrading current monitoring systems and with instrumentation vendors. The discussions identified literature regarding current and possible future systems, databases, and technology information transfer programs that were reviewed. Evaluation of existing air and surface water monitoring systems and the strengths and limitations of technology involved in those systems provided the first step in understanding what is possible in monitoring D&D.

New technologies in the R&D stages were also reviewed but not completely evaluated because of scheduling constraints. R&D technologies for real-time monitoring at the environmental levels of radiological and nonradiological parameters in air and surface water do exist. However, these technologies require more evaluation to determine their applicability, cost effectiveness, and reliability.

R&D of new monitoring technologies is an ongoing process that includes the work of both public and private section organizations. Within DOE, several organizations include the Environmental Technologies Group at RFP, the Los Alamos National Laboratories Technologies Group, and the Nevada Field Office, Office of Technology Development. These organizations as well as manufacturers of equipment currently in use at RFP were consulted to determine the most recent innovations and improvements to existing instrumentation and to learn about new technologies that are under development. Development of innovative technologies must address the problem of providing instrumentation with sufficient sensitivity for environmental use, the difficulty in

providing accurate real-time measurements, and the complexities associated with the measurement of radiological parameters.

9.4.1.1 Air Monitoring Technologies

Air monitoring programs at RFP emphasize measurement of radioactive contaminants in effluent and ambient air, although some nonradioactive constituent monitoring occurs.

Radiological Emissions. Radiological emissions are currently monitored by a three-tier program involving SAAMS, direct counting of TLLA and TLLB contamination in particulates collected from effluent air, and radioisotopic analysis of the particulates. The three components of the monitoring have significant variations in the time required for completion of analyses and sensitivities.

Selective Alpha Air Monitoring. The SAAMs or CAMS are currently used to provide real-time detection and alarm capability for off-normal or accidental release situations from air stack emissions. These instruments could be used not only to warn personnel by audible alarm but also to actuate equipment/corrective measures that may minimize the magnitude of a release. A more complete discussion of CAMs is presented in Section 6.0. RFP is currently reviewing the air emissions programs for possible monitoring improvements.

CAMs are sensitive to specific alpha particle energies at occupational exposure levels that correspond to plutonium-239/240. No other instrumentation was determined to be currently available for direct real-time air monitoring of alpha activity at environmental levels.

Newer CAMs, which are available, offer improved performance over the current instruments in use at the RFP. Instrument improvements are related to the particulate collection efficiency and sensitivity. In general, the sensitivity of this method of radioactivity detection at environmental levels is limited because of interference by short-

lived alpha activity (i.e., radon-222 and thorium) emitted from naturally occurring radionuclides.

The CAM instruments currently used for continuous detection of alpha emitting radioactive aerosols at RFP may be adequate for air-duct emissions monitoring during D&D monitoring activities. However, newer, improved instruments should continue to be evaluated to determine possible upgrades. In addition, portable CAMs may be suitable for ambient air monitoring at elevated occupational levels adjacent to D&D activities. Portable CAMs are available for monitoring ambient alpha particle releases both indoors and outdoors. Portable CAM instrumentation is not suitable for monitoring at the Industrial Area perimeter because of the high sensitivity of the instrument. CAM equipment for monitoring ambient air should be located as close as possible to the D&D activity to decrease the influence of air dispersion and increase the detection of alpha particles.

Particulate Emissions Monitoring. Particulate emission monitoring consists of two steps: screening of air-duct emission particulate sample filters and radiological activity counting for TLLA. Each filter is scanned for radioactivity using a portable alpha particle survey meter with an air proportional alpha detector before being removed from the holder and submitted for analysis. The second step is a TLLA activity count. Alpha radiation is the principal type of radiation associated with radionuclide emissions at RFP. It can be measured by total alpha radiation detection. However, naturally occurring short-lived radionuclides, such as radon and thorium decay products, contribute to the total alpha activity. This contribution of decay products can be quantified by taking two counts of the air filter samples within 24 hours after collection to allow for the additional decay of this short-lived activity and again after 72 hours of decay. TLLA, which results primarily from plutonium, uranium, and americium, is estimated from the results of the two counts. This screening method provides a more sensitive analysis of radioactive duct emissions than SAAMs but requires a longer turnaround time for the laboratory data.

Specific Radioisotope Analyses. Laboratory analyses for specific radioisotopes in effluent air particulate samples is a complex process involving dissolution of the filters used to collect the particulates, separation of the constituents of interest, plating the constituents on a planchette, and counting the planchettes with sensitive detectors. Detailed quality assurance/quality control procedures, such as the use of laboratory spikes with tracers to assure proper recovery of the radioisotopes of interest, are used to assure accuracy of the analyses. The advantage of the process is the low level of detection. The disadvantage is that four to six weeks elapse before results are available. Detection limits can be reduced by adding more time for the analyses. For example, additional sensitivity can be achieved by increasing the counting time.

Gas Monitoring. Tritium is the only gaseous radioactive emission material routinely monitored at RFP. Tritium is monitored through liquid scintillation counting of discrete bubble impinger samples. Currently, scintillation counting persists as the most widely used industry technique for the analysis of tritium in water. However, improvements in the signal processing technology (both hardware and software) have improved the performance of modern scintillation spectrometers.

Nonradiological Emissions Monitoring. Beryllium emissions are sampled using the same methods and filters used for the radioisotope stack sampling previously described. The analytical method of analysis by Graphite Furnace Atomic Absorption of berylluim samples is considered the best available analysis technique. Additional metal emissions sampling could also use this sampling technique and appropriate methods. A more complete discussion of beryllium monitoring is included in Section 6.0.

Volatile Organic Compound Emissions. No VOC emissions are monitored by RFP. The changes in mission at RFP have led to a decrease in VOC use and VOC emissions from the plant. Online gas chromatograph monitoring instruments usually require high maintenance to achieve reliable monitoring goals. Summa canisters and Tenex tubes, other monitoring equipment, are also available. These VOC monitoring instruments are described in more detail in the ambient air monitoring section.

Radiological Ambient Monitoring. The RFP radioactive ambient monitoring program described in this section consists of two programs: the RAAMP program and the OU-specific monitoring program. Both air monitoring programs measure ambient plutonium, americium, and uranium particulate concentrations by collecting particulate samples using high-volume air samplers followed by radiological laboratory analysis. The RAAMP and OU-specific air monitoring methods are not real-time monitoring technologies because of the laboratory analysis required. The current RAAMP and OU-specific monitoring programs are discussed more completely in Section 6.0.

Technologies involved in sample collection will be important in performing ambient air monitoring. For example, ultrahigh-volume air samplers are being developed. The advantage of ultrahigh-volume air samplers is that less time is required to collect adequate sample volume.

Nonradiological Ambient Monitoring. The RFP nonradiological ambient monitoring program currently consists of TSP monitors, PM-10 particulate monitors, VOC monitors, and metals monitoring. Recommendations included in this report include monitoring SVOCs, pesticides, and additional metals.

TSP, PM-10 particulates, and beryllium are currently being monitored at four nonradiological particulate air sampling stations at RFP. Three of the samplers are maintained by CDH; the other station is maintained by EG&G. Nitrogen oxides are also monitored at one of the CDH air stations. A more complete discussion of nonradiological ambient monitoring instruments is provided in Section 6.0.

Ambient Volatile Organic Compounds. Currently, no VOC monitoring is performed in the Industrial Area other than worker protection during activities that could release VOCs. CDH's Air Quality Control Division does monitor for VOCs at three locations outside and along the RFP boundary, and two additional monitoring stations for VOCs are planned. Power access and land use permission are pending. CDH's air monitoring

program uses Tenex tube air sampling instruments and EPA analysis Method TO-1 to monitor for VOCs.

Two laboratory-supported time methods and one real-time method are commercially available for the detection of VOCs in air at environmental levels. The two laboratory-supported time methods are Summa canisters and Tenex tubes that are supported by accurate and sensitive analysis. Portable gas chromatograph instrumentation is the real-time continuous monitoring method used for measuring VOCs. Assessment of portable gas chromatograph instruments determined the instruments require high maintenance, are unreliable, and are not capable of laboratory detection levels. Collection of samples for laboratory analyses provides accurate measurement and is recommended where appropriate for specific D&D documentation.

Metals. Metals analysis may be performed on filters collected for particulate concentrations by high-volume and ultrahigh-volume air samplers. No real-time direct measurement monitoring instruments were identified for metal analysis in air at environmental levels.

Air Pollution Prevention and Fugitive Emissions Control - IAG Programs. The monitoring equipment used for the Air Pollution Prevention and Fugitive Emissions Control (IAG Programs) is primarily related to occupational safety monitoring during short periods (less than 10 hours). The equipment is portable and provides direct and indirect real-time measurements of air quality. The instruments are designed to be used as close as possible to the work area (within approximately 5 to 10 meters).

The monitoring equipment recommended for use during the Air Pollution Prevention and Fugitive Emissions Control activities for air contaminant measurement include TSI piezobalance instruments, high-volume samplers, laser particle counters, MINIRAM, HNu trace gas analyzers, and Photovac Microtip handheld air monitors (DOE 1991a). A more detailed discussion of the instruments and the procedures used for air pollution

prevention and fugitive emissions control activities is provided in the *Final PPCD* (DOE 1991a).

9.4.1.2 Surface Water Technologies Assessment

The goal of the surface water monitoring technologies assessment was to identify technologies and monitoring instrumentation that could be used to monitor surface water quality during D&D activities. Applicability of monitoring and sampling equipment will be determined in part by the known or suspected COPCs related to a specific location or D&D activity.

Real-Time Telemetry Monitoring Systems. Radio-telemetry stations are currently used to collect real-time water quality parameters at 12 monitoring stations located within the RFP boundary; two stations are positioned within the Industrial Area. The existing telemetry monitoring stations coupled with the establishment of additional telemetry monitoring stations may provide data that could be used to determine base-line COPC concentrations. Additional telemetry monitoring systems could be located downstream of D&D activities or within related surface water drainage subbasins to establish base-line water quality before D&D activities begin.

In addition, surface water quality could be monitored during implementation of D&D operations to detect real-time changes in surface water quality. Real-time monitoring of surface water parameters may allow for the most timely detection of abnormal surface water conditions and corrective measures response. The radiotelemetry monitoring stations are portable and solar-powered. Because the units are portable, they may allow for monitoring units to be repositioned to new D&D locations when previous D&D activities have been completed. Siting of the units is limited only by the line of sight of the radio telemetry repeater tower.

Automated Surface Water Sampling. Thirteen stream gaging stations within the RFP buffer zone are equipped with automated sampling equipment (EG&G 1992l). The

existing automated surface water stations combined with additional automated surface water stations may provide a better understanding of base-line surface water quality conditions in D&D-specific locations or a drainage subbasin related to a specific D&D activity. The automated samplers could be programmed to collect samples during specific periods of potential releases to surface water. Specific periods of potential releases may include implementation of D&D activities, snowmelt, and high storm-water events. Time-weighted composite samples could also be collected at automated surface water stations to establish base-line surface water quality conditions.

Automated surface water stations could be co-located with real-time telemetry monitoring stations to increase sampling and instrument maintenance efficiency. As recommended in Section 5.0, these monitoring stations should be established and be operative before beginning decontamination activities.

Surface water samples could be collected and laboratory-analyzed for a variety of parameters including suspended sediment, total metals, total radionuclides, and organic constituents. Flow rates through flumes, weirs, and culverts could also be measured at automated surface water stations.

Each existing station has a permanent flow structure (i.e., weir, flume, culvert). The automated samplers could be easily disassembled and relocated to another D&D activity location; however, the flow structures are permanent. The monitoring stations are powered by a combination of battery packs, alternating current power lines, and solar panels. Several of the existing gaging stations at RFP are already part of the radiotelemetry system.

Field Parameter Monitoring. Field parameter monitoring can be used to quickly investigate a possible upset condition and to identify locations where more detailed sampling and analysis are required. Parameters such as flow, pH, turbidity, and temperature, perhaps in combination with qualitative chemical analyses in the field, can

give fast definition of basic water quality. Time elapsed is critical in defining response to a possible spill to surface waters.

9.5 VERIFICATION MONITORING RECOMMENDATIONS

As D&D activities are developed, consideration will be given to potential hazards, including constituents that could be released and activities that could cause such releases. Both verification and D&D monitoring will be activity- and constituent-of-concern-specific. Knowledge of contaminant transport mechanisms and detectability are essential to instrument selection. Verification monitoring will be a combination of real-time and long-term-residence time sampling that typically requires laboratory analysis. Real-time devices will provide direct measurements of general chemical categories; long term samplers will provide quantitative results.

A detailed work package similar to those developed for transition activities will be prepared for D&D activities. This package will address the D&D planning considerations identified in Section 9.2. COPCs will be identified using the approach described in Section 9.2.1. Verification monitoring locations and specific details concerning instruments and sampling frequency will be included in the work package and may require that activity modeling be performed. When possible, both real-time instruments and instruments not capable of real-time monitoring currently in use at RFP will be used to limit expense and additional training. Additionally, experience with instruments gained during OU RI and environmental investigations will be incorporated into the verification monitoring programs.

The assessment of monitoring technologies provided in this IM/IRA/DD determined that the current monitoring systems at RFP are well designed and represent up-to-date technology. In general, the surface water and air monitoring programs assessed represented the best available technologies and adequate instrumentation for the monitoring of radiological and nonradiological COPCs.

The efforts of the assessment determined that no real-time analytical methods or instrumentation are currently commercially available for directly monitoring radiological parameters at environmental levels in air or surface water. However, nonradiological methods and instrumentation are available for monitoring air and surface water quality.

Air and surface water quality monitoring for indicator parameters, such as airborne particulates and general surface water and air quality parameters, were identified as the only indirect means for real-time monitoring of radiological air and surface water concentrations. Therefore, a priority of the assessment was placed on the use, applicability, and implementation of existing nonradiological instrumentation and monitoring systems currently supporting the RFP surface water and air monitoring programs.

The basic technologies in use are adequate for their intended purpose. Few available technologies would enhance the sensitivity or sample collection reliability of the current network; but, when appropriate, those technologies identified in Section 9.4 should be incorporated into the monitoring program.

Examples of real-time monitoring include measuring TSPs to estimate radiological particle concentrations in air, measuring total VOCs in air, and monitoring water quality parameters and flow that may indicate a change in conditions.

Monitors that are not designed to provide real-time measurements will include the current air and surface water networks. These networks will be supplemented with similar samplers or instruments at locations specific to D&D activities.

Response action levels will be developed from base-line levels established by the current RFP monitoring program, OU-specific measurements where applicable, and base-line conditions established before D&D. Recommendations for determining base-line levels were made in the media-specific sections of this IM/IRA/DD.

9.6 RESPONSE PLANNING

Existing RFP emergency response plans and methodologies provide a link to the comprehensive existing systems for responding to potential releases during D&D. A plan specific to release response during D&D has not yet been prepared. The *RFP Transition Plan* (DOE 1992a) describes an emergency response approach that is based on existing RFP emergency program elements and designed for transition. A D&D emergency response link may be developed using the *Rocky Flats Plant Site-wide Environmental Compliance Program Management Plan* (EG&G 1993rrtt) and *EPLAN* (EG&G 1993w). These plans are described in the following paragraphs.

The *Rocky Flats Plant Site-wide Environmental Compliance Program Management Plan* (EG&G 1993rrtt) documents a formalized program to address statutes related to environmental protection, waste management, and environmental restoration. Section 9.0 of the plan identifies DOE orders and federal and state environmental laws and regulations that address environmental occurrence notification and reporting requirements and the existing programs at RFP that have been established to meet the requirements.

The RFP EPLAN establishes the planning, preparedness, and response concepts for emergencies at the plant. The goals of the EPLAN are to protect the health and safety of onsite personnel and the public, limit damage to facilities and equipment, minimize impact to onsite operations and security, and limit adverse impacts on the environment (EG&G 1993w). A summary of the contents of some EPLAN sections follows:

- Section 4.0 provides the definitions of emergency event classes and emergency action levels used at RFP.

- Section 6.0 describes the hazards assessments process used as the basis for emergency planning and the consequence assessment process for obtaining and coordinating initial and continuing emergency information and situation-dependent field data.

- Section 7.0 outlines protective actions based on protective action guides and emergency response planning guidelines, defines the RFP emergency planning zone, and describes requirements for personnel accountability, communications, termination of an emergency, and shutdown of operations.

Additionally, procedures for emergency notifications are set forth in the *RFP Policy Manual* (EG&G 1993uu) and *Planning and Preparedness for Operational Emergencies* (EG&G 1993vv), both of which are frequently updated.

9.6.1 Emergency Response

According to the EPLAN, when an event or condition is discovered, initial response follows these standard procedures:

- The employee discovering the event reports the condition to a supervisor, building management (Operations/Shift/ Building/Facility Manager), or shift superintendent, or calls RFP extension 2911. (Note that discovery of an event or condition could originate with an alarm indicating an out-of-normal condition. Such alarms often are tied to various emergency response systems.)

- Building management categorizes the occurrence, notifies the shift superintendent (all occurrences), implements the Building Emergency Plan and Implementing Procedure, as appropriate, and directs initial preliminary assessments for building occupants. (A shift superintendent is always on duty.)

- Based on the severity of the event, and building management's recommendation on the categorization or emergency classification, the shift superintendent reviews known information in accordance with 1-38300-ADM-16.02, Occurrence Categorization, and 1-15200-EPIP-04.01, Emergency Classification. The RFP Response Flow Chart (EG&G 1993bb) provides the process for categorizing, classifying, and responding to occurrences and emergencies.

DOE-RFO, Rocky Flats management, and subcontractor employees are required to report occurrences as defined in DOE Order 5000.3B, Occurrence Reporting and Processing of Operations Information. A leaflet entitled "Employee and Subcontractor Occurrence Reporting Notification Process" was prepared by Facility Operations Management (Environmental Restoration). The leaflet defines an environmental occurrence, an event, and a condition, and includes emergency telephone numbers and a checklist of important information to notice during an emergency. The system includes the following activities related to occurrences: identification, categorization, notification, critique/fact-finding, root-cause analysis, corrective actions, reporting, and lessons learned.

To support immediate response, RFP maintains 24-hour emergency response capabilities by ensuring that a shift superintendent, fire department personnel, emergency medical technicians, an ambulance service, and area safety, security, operations, and maintenance personnel are available at the facility. Additional subject matter experts are on call to provide support in a variety of areas. Environmental, medical, safety, industrial hygiene, security, regulatory, and facility experts are included in this cadre.

It is recommended that the occurrence reporting procedure be used during D&D activities. Action levels or out-of-normal conditions can be expanded to include the D&D activities, and necessary D&D activity managers can be included in the emergency response flow chart.

9.6.2 Source Investigation

The D&D activity and planning of that activity will provide invaluable information regarding the potential sources of contamination released. This planning will include identification of COCPs and methods for detecting releases. It is also important to preplan the criteria for conditions that will require an investigation in response to elevated contaminant levels. This preplanning will include developing a sampling plan based on both analytical requirements and objectives of the monitoring. Action levels will be established from base-line concentrations measured before starting D&D activities

and communicated to the analyzing laboratory, which will assure that investigations can be initiated quickly after it is determined that an analyte has exceeded the action-level concentration. Detections above the site-specific action level will initiate source investigations to determine the point of release and cause of release. This investigation will include a determination of the adequacy of pathway protection, D&D procedures, and an assessment of the activity D&D monitoring. Investigation findings will be used to determine the necessity and type of corrective actions required.

(intentionally blank)

10.0 FUTURE CONCEPTUAL SITE MODEL

The future conceptual site model for the Industrial Area at RFP considers the potential contaminant transport pathways associated with sources expected to exist during D&D of buildings and other facilities. This model differs from the model in Section 8.0, where current conditions and unplanned events are considered. OU activities, described briefly in the current scenario, are addressed in OU-specific work plans. The future model addresses potential contaminant releases in the Industrial Area after the transition phase described in Section 9.0 has been completed and D&D activities are under way. Because activities planned for D&D are not currently well defined, a generalized approach to D&D activities has used to develop the future model. The models presented in Section 8.0 were the bases for the conceptualization of future potential contaminant migration presented in this section. Like the current and unplanned events models, the future model evaluates potential contaminant sources, release mechanisms, and transport media. Evaluation of potential exposure routes and receptors is not addressed in this IM/IRA/DD.

10.1 CONSTITUENTS OF POTENTIAL CONCERN AND SOURCES

An approach for identifying COPCs for environmental monitoring during D&D was described in Section 9.2.1. The approach relies on the COPC list developed for current conditions in the Industrial Area at RFP (Section 3.0). This list is extensive, but it is anticipated that the list can be reduced by incorporating information from characterization and hazard assessment activities performed during transition. As mentioned previously, the bulk of chemical products and hazardous wastes stored in buildings and tanks will be removed during transition. Additionally, internal decontamination will be completed before the structural integrity of a building is reduced by D&D activities. The current conditions COPC list will be refined to apply to a specific building or area and D&D activity.

The primary sources of contamination associated with D&D activities include areas where fixed and residual contaminants remain after transition phases have been completed. These sources include (1) routine effluent emissions from building exhaust stacks and ventilation systems; (2) residual chemicals or waste in equipment, tanks, piping, and building structures; (3) incidental waters from building floor and foundation drains, sumps, and valve vaults; and (4) contaminated soils underneath buildings exposed during D&D.

10.2 PATHWAYS

A transport or migration pathway consists of a release mechanism and transport media. The future conceptual site model identifies potential contaminant sources and transport pathways for D&D activities. Figure 10-1 presents the conceptual site model flow diagram for potential releases during D&D. Primary and secondary sources, release mechanisms, and transport media are identified in this figure. The release mechanisms for current activities and D&D are similar except that D&D activities may introduce additional primary release mechanisms. These release mechanisms would be the result of new and different types of activity conducted specifically during D&D. Figure 10-2 depicts the model.

10.2.1 Primary Release Mechanisms

As mentioned above, the primary release mechanisms related to D&D activities are similar to those presented in Section 8.0. Primary release mechanisms presented in Section 8.0 that may apply also to D&D are (1) historical spills, leaks, or overflows; (2) volatilization from contaminated soils and surface waters; (3) fugitive dust emissions from contaminated surface soils; (4) erosion, runoff, and overland flow of contaminated surface waters or soils; (5) infiltration and percolation through soil; (6) discharge and overflow from building foundation and footing drains; (7) effluent emissions from ventilation systems; and (8) direct contact with radioactively contaminated equipment or

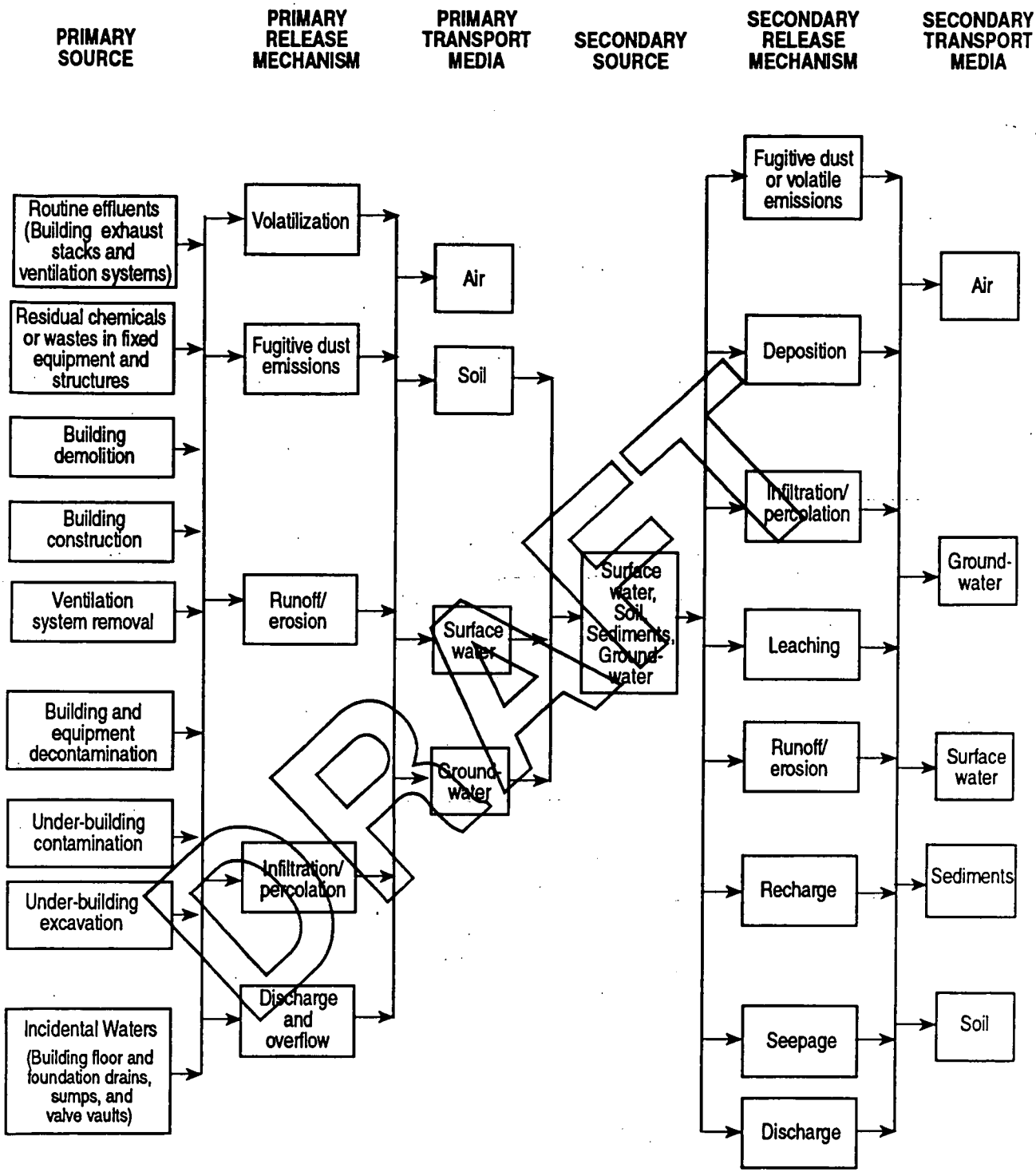


FIGURE 10-1
Industrial Area IM/IRA/DD
Future Conceptual Site Model Flow Diagram
D&D Activities Scenario

materials. Additional preliminary release mechanisms specific to D&D include (1) volatilization from residual constituents in equipment, tanks, and piping; (2) fugitive dust emissions from equipment and ventilation system removal and building demolition; (3) releases to incidental waters from building and equipment decontamination; (4) contaminant release to building floor, foundation, or footing drains from decontamination water; (5) volatile and fugitive emissions from underbuilding soil excavation; and (6) runoff or overland flow from excavation of UBC areas.

10.2.2 Primary Transport Media

Primary transport media are directly affected by the initial contaminant release and are dependent on the type of source and specific release mechanisms. Primary transport media for potential releases during D&D include air, surface water, soil, and groundwater.

Airborne transport may occur as a result of routine emissions, volatile emissions from contaminated building structure (e.g., concrete flooring), soil, surface water, or from residual constituents in equipment, tanks, piping, and from windblown surface soil migrating as fugitive dust. Airborne contaminants may be transported directly to a receptor or eventually be deposited to a secondary source such as surface soil, sediment, or surface water by particulate deposition, rain-out, or washout. Contaminants released directly to the soil can be transported to a secondary source by infiltration and percolation, leaching, runoff, or erosion. Contaminants may be transported by surface water in overland flow or runoff when direct release to the surface occurs. Releases from below-ground tanks and piping, UBC, or buried sources may infiltrate into surrounding soils. UBC may be directly released to groundwater, and incidental waters may carry contaminants to the groundwater.

10.2.3 Secondary Sources

Contaminant migration is further characterized through identification of secondary sources. As defined in the current model, a secondary source is the medium that receives released constituents. Air is not considered a secondary source because it acts only as a transport medium to other media. Secondary sources in the Industrial Area include surface water, soil, sediment, and groundwater.

Surface water may be a secondary source for contaminant release because of (1) direct discharge to drainages from contaminated incidental waters, (2) release of building or equipment decontamination waters, (3) runoff from contaminated surfaces exposed during D&D, or (4) contaminated groundwater seeps into surface drainages.

Surface soil, sediment, and subsurface soil may be secondary sources because they receive contaminants through erosion, runoff, infiltration, and percolation, and from air as particulate fallout, rainout, and washout.

Groundwater may be a secondary source as a result of UBC.

In the past, some secondary sources were created because historical releases were not controlled by engineering controls or detected by monitoring systems. It is anticipated that secondary sources during D&D will be less likely to occur than in the past for the following reasons:

- All nonfixed materials, equipment, chemicals, and wastes will be removed during facility transition and will, therefore, reduce the number of primary sources present during D&D, thereby eliminating the concern for potential releases.

- Transition will include thorough characterization of facilities, including contaminant pathways.

- Engineering controls will be developed and implemented during D&D based on the transition assessments and planned activities, and designed to control releases.

- Activity-, media-, and COPC-specific monitoring programs will be implemented before D&D begins, allowing early identification and response to releases.

10.2.4 Secondary Release Mechanisms

Secondary release mechanisms during D&D would be similar to the secondary release mechanisms described in Section 8.2.4. The reader is referred to that section for more information concerning potential mechanisms.

10.2.5 Secondary Transport Media

Transport continues as constituents migrate through the environment over time. Secondary transport media are those that receive contaminants released from a secondary source through a secondary mechanism. Secondary transport during D&D would be similar to the description for the current scenario provided in Section 8.2.5.

10.3 RELATIONSHIP OF THE FUTURE CONCEPTUAL SITE MODEL TO DECONTAMINATION AND DECOMMISSIONING MONITORING PROGRAMS

Monitoring during D&D will include worker safety monitoring, activity-specific monitoring, and environmental verification monitoring. Worker safety monitoring may be used in the early identification of releases to the atmosphere and will consist of real-time measurements and monitoring that requires laboratory analysis. Activity-specific and verification monitoring may include real-time measurements and monitoring that requires laboratory analyses. Laboratory analysis typically provides better quality data but also requires several days. Activity-specific monitoring programs will be

developed as D&D work packages are prepared and are not presented in this IM/IRA/DD. Verification monitoring will be performed to verify measurements made with D&D activity-specific monitors and to verify that engineering controls and pathway protection procedures are functioning properly. Recommendations for verification monitoring are made in Section 9.5.

Monitoring results obtained during D&D activities can be evaluated to assess existing controls and monitoring and to develop additional controls and monitoring if warranted. In general, monitoring programs in use during D&D activities combined with engineering controls and experience gained during transition will reduce the potential for contaminant release.

The future conceptual site model identifies the media and transport mechanisms from primary and secondary sources from general D&D activities. This information can be used in planning the necessary engineering controls to limit or eliminate potential releases. It can also be used to identify the required monitoring to verify that the engineering controls are effective.

(intentionally blank)

11.0 SUMMARY OF FINDINGS AND RECOMMENDATIONS

This section summarizes the monitoring program assessments. The recommendations for future studies, new monitoring locations, and analytical parameters are presented in the following subsections.

11.1 MAJOR FINDINGS - GROUNDWATER

Sitewide, RFP has 455 active wells and piezometers in the groundwater monitoring network. Of these, 371 are monitoring wells and 84 are piezometers. Approximately 165 monitoring wells and piezometers are located in the Industrial Area.

Groundwater monitoring is performed under several different programs that are conceptually linked under the GPMP. The groundwater monitoring wells are divided into six subsets based on the purpose of the well and on regulatory requirements. The following is a list of the six subsets:

- Background Monitoring to detect levels of chemical constituents at locations not affected by RFP activities;

- RCRA Regulatory Monitoring to monitor the upper hydrostratigraphic unit within and immediately adjacent to RCRA Units;

- RCRA Characterization Monitoring to characterize and/or monitor hydrostratigraphic units other than the upper hydrostratigraphic unit at or near RCRA Units;

- CERCLA Monitoring to characterize groundwater and the extent and movement of constituents as part of RI/FS activities;

- Boundary Monitoring to monitor groundwater movement and quality at the downgradient RFP boundaries; and

- Special Purpose Monitoring, which includes other wells that are used to characterize groundwater and hydrogeology.

Water-level measurements are obtained each quarter for all 485 active wells and piezometers and monthly in approximately 95 wells and piezometers. Groundwater samples are collected quarterly from all active wells designated for groundwater monitoring.

The standard analytical set for groundwater samples consists of the following:

- TCL VOCs;
- water quality parameters and anions;
- gross alpha and gross beta;
- uranium, cesium, radium, and strontium (dissolved);
- TAL metals and cesium, lithium, molybdenum, strontium, and tin;
- tritium, plutonium, and americium (total); and
- cyanide.

SVOCs are analyzed only during the first quarter after installation of a new well. If SVOCs are detected during the initial analysis, they continue to be analyzed during subsequent sampling from that location.

The upper hydrostratigraphic unit may be a pathway for transport of constituents released from surface sources that may leach through permeable surficial soils to the water table by infiltrating precipitation.

The lower hydrostratigraphic unit is not considered a potential contaminant pathway because of the low hydraulic conductivity and discontinuous nature of the Laramie Formation sandstones. These two elements suggest there is no viable migration pathway for contaminants to reach ground surface from the lower hydrostratigraphic unit.

The locations of monitoring wells and frequency of sampling are generally adequate in the eastern Industrial Area. Groundwater monitoring coverage in the western and central Industrial Area is not adequate to provide early detection of constituent releases to groundwater.

11.2 RECOMMENDATIONS - GROUNDWATER

The following list includes the major recommendations for the groundwater medium:

- Seventeen existing wells are recommended for IM/IRA monitoring and 10 are recommended conditionally. Further recommendations will be made following receipt and review of 1993 groundwater sample results for volatiles, metals, and radionuclide analyses.

- Install additional monitoring wells in the upper hydrostratigraphic unit in the central portion of the plant.

- Install two bedrock wells at selected locations where building foundations are set in bedrock and where past analysis of footing drain waters has indicated elevated levels of radionuclides or organic constituents or where the occurrence of UBC has been documented. (These wells are described in Table 4-7 in Section 4.0.)

- Install 11 alluvial monitoring wells in the central and west areas of the Industrial Area. (These wells are described in Table 4-7 in Section 4.0.)

- Collect groundwater samples on a quarterly basis for one year to establish baseline groundwater chemistry. The frequency of monitoring will be evaluated annually after the first year depending on the upgradient activities. Monitoring well samples will be collected semiannually if D&D activities are occurring within 25 feet upgradient.

- Drill exploratory boreholes using geoprobe/hydropunch technology to determine the occurrence and availability of groundwater before monitoring well construction.

11.3 MAJOR FINDINGS - SURFACE WATER

The RFP surface water and sediment monitoring program consists of compliance, operational, and characterization monitoring programs. As of January 1994, the surface water monitoring system included the following:

- NPDES/FFCA and AIP compliance-related monitoring that includes the monitoring of the A-, B-, and C-series terminal ponds and the STP;

- DOE operational monitoring that includes monitoring of the A-, B-, and C-series ponds, the STP, and runoff from the 750/904 Pad; and

- Event-related Monitoring Program, Pond Effluent Treatment Research, and various nonroutine support activities involving water and sediment sampling, including monitoring of two of the NPDES storm water stations and monitoring of 21 gaging stations.

Seven drainage pathways can be defined for surface water runoff draining the Industrial Area under normal flow conditions. These drainage paths link subbasins that drain to six storm water NPDES monitoring stations. Four of these stations have not been

monitored since October 1992. Of these four, one will be deleted and three will be brought back on line in March 1994.

NPDES permits for storm water are not required within the Industrial Area but are required at the boundary where storm water leaves the site; therefore, data on storm water within the Industrial Area are not routinely generated and are insufficient to identify constituents that may be present in the storm water. In addition, surface water base flows in the Industrial Area are not sufficiently quantified.

As of January 1994, 21 gaging stations are in the event-related monitoring programs. Of these, only five are near the perimeter of the Industrial Area. It is anticipated that stations that are to be part of the long-term network, which includes two of those close to the Industrial Area boundary, will be equipped with automated flow measurement devices and automatic samplers, and radiotelemetry to monitor flow parameters such as precipitation, discharge, and stream stage.

Under the existing STP NPDES permit, the influent to the STP is currently (January 1994) monitored for pH, conductivity, and microbiological activity using a respirometer. Additionally, a real-time, radio-based remote surface water monitoring system is being developed as part of the overall surface water monitoring program. Currently, nine gaging stations will be equipped with automated flow measurement devices, automatic samplers, and radiotelemetry capabilities to monitor basic flow parameters such as precipitation, discharge, and stream stage on a real-time basis.

Surface water and sediment was characterized in the 1989 and 1990 Surface Water and Sediment Geochemical Characterization Reports prepared by EG&G (EG&G 1992j; EG&G 1992k). Areas of surface water contamination within the Industrial Area include the Solar Ponds area, the 903 Pad area, and Upper South Walnut Creek near the northeastern Industrial Area boundary. The major elevated constituents in the Solar Ponds included specific conductivity, pH, chloride, sulfate, nitrite/nitrate, various metals,

a variety of radionuclides, VOCs, SVOCs, and one PCB detection. In the 903 Pad area, radionuclides, VOCs, and a few metals were detected. In the Upper South Creek area, metals, plutonium, and VOCs were detected. A surface water IM/IRA is being implemented at OU2 (Upper South Walnut Creek), which includes the 903 Pad and Mound areas, to treat contaminated surface water. OU4, the Solar Ponds, is undergoing a Phase I RFI/RI.

Data regarding the western and southcentral portion of the Industrial Area are limited. It is possible that IHSSs in the western Industrial Area may contribute to elevated levels of sulfate, radionuclides, and some metals in the upper SID.

Trends in surface water hydrology and constituent fate and transport at RFP are reported for 12 gaging stations in the 1991 and 1992 Findings of Event-related Surface Water and Sediment Monitoring Reports for RFP (EG&G 1993m). Only general conclusions were made in this report because of the limited quantity of data, analyte concentrations near the analytical detection limit, and questionable discharge data quality.

Storm water monitoring was conducted for the CWA NPDES Permit Application. A total of 116 surface water samples and 19 bulk-precipitation samples were collected and analyzed during a 15-month period from October 1991 through December 1992 that included 32 storm or high-flow events. Chemical analyses include selected trace metals, anions, and nutrient species. These sample results provide an integrated water-quality characterization during a prolonged storm runoff/high-flow hydrograph period.

11.4 RECOMMENDATIONS - SURFACE WATER

The following are the major recommendations for the surface water medium:

- Install additional surface water sampling stations in areas where seeps occur or where base flow is in a drainage. The sampling locations should be based on a

detailed (point-by-point) analysis of existing surface water monitoring data and locations.

- Install new surface water sampling stations at the boundary of each drainage subbasin whenever possible during D&D activities.

- Evaluate subbasins for base flows and water quality to establish base-line water quality data before conducting D&D activities.

- Assess overall mass pollutant loading to the drainage basins and drainage ponds under base flow conditions. This mass balance should particularly address VOCs that are most likely to be identified in the flow from seeps and springs.

- At each station at which base flow sampling is conducted, install permanent and automatic flow measurement devices that transmit base flow data to a computer.

- Evaluate base-line quality conditions for base flows for the entire RFP analyte list.

- Monitor base flow quality conditions during D&D activities for COPCs identified for that subbasin. The identification of COPCs should be based on the base-line water quality data and the major use or storage of any compounds within a building, or waste management areas in the subbasin.

- Implement a program to continue monitoring all base flow surface water sampling locations within the Industrial Area at which VOCs, heavy metals, or radionuclides have been identified in elevated concentrations.

- Establish new storm water sampling stations at the boundary of each drainage subbasin. These stations are recommended to establish base-line conditions before beginning D&D activities within a drainage subbasin.

- Install permanent and automatic flow measurement devices that transmit the data to a computer at each station where storm water sampling is conducted.

- Monitor storm water based on a specific drainage basin or subbasin for each storm event above the minimum storm that does not create substantial runoff from a basin or subbasin.

- Install automatic flow monitoring equipment at the four to six culverts located at the south side of the Industrial Area so that releases of liquids can be detected immediately.

- Evaluate base-line quality conditions for storm water flows for the entire RFP analyte list.

- Monitor storm water flow quality conditions during D&D activities for COPCs identified for that subbasin. The identifications of COPCs should be based on the base-line water quality data, the major use or storage of any compounds within a building, or waste management areas in the subbasin.

- Develop an overall mass pollutant loading on a drainage basin and subbasin basis for storm water transport of contaminants.

11.5 MAJOR FINDINGS - AIR

The RFP air monitoring system consists of four subprograms: radiological effluent emissions, nonradiological effluent emissions, radiological ambient monitoring, and nonradiological ambient monitoring.

Radionuclide air effluent emissions are continuously monitored and sampled at all release points with the potential of discharging uncontrolled radionuclides into the air in quantities that could result in an EDE greater than 0.1 mrem/yr.

Monitoring results provide a measure of radioactive particles that are not removed from effluent by the HEPA filtration system. Approximately 130 emissions samplers are located in 63 air exhaust ducts within 17 buildings at RFP. Emission monitoring includes 39 SAAMs, 130 in-stack particulate monitoring samplers, and six gas monitoring locations for tritium.

Nonradiological emissions sampling consists of measuring Be concentrations on the filters collected for radiological particulate analysis. Additionally, VOC emissions are estimated from chemical inventories and quantities used and are reported in APENs.

The ambient air monitoring program includes the RAAMP and the OU-specific monitoring programs. The dispersion of airborne radioactive materials is continuously monitored at 47 locations at RFP and nearby communities. The Industrial Area is monitored with 22 samplers; 19 are within or at the fence line of the Industrial Area and the remaining are less than 1 mile from the Industrial Area fence. Community radiation monitoring is conducted at each of the cities of Broomfield, Arvada, Westminster, Northglenn, and Thornton. Ambient air monitoring for suspended particulate monitoring will be conducted during environmental investigations at 16 OUs as part of the *PPCD* (DOE 1991a).

Nonradiological ambient air monitoring is conducted by RFP at one location that includes two TSP and two PM-10 samplers. Additionally, meteorological monitoring, weather forecasting, and air dispersion modeling are performed at RFP. CDH maintains 16 samplers that measure radiological and nonradiological particulates, VOCs, metals, and nitrogen oxides.

Air dispersion models for RFP have been used for air quality analysis, emergency response, and to estimate contaminant concentrations. Air dispersion models have also been used by CDH to predict contaminant concentrations associated with the routine release of contaminants from the filter plenum exhaust and from accidental releases.

11.6 RECOMMENDATIONS - AIR

The following are major recommendations for the air medium:

- The current radionuclide effluent emission monitoring program is more than adequate to characterize concentrations in the Industrial Area. No changes to the current effluent emissions monitoring program are recommended.

- Beryllium sample collection frequency should be decreased or halted until D&D begins in process and storage areas, as recommended by EG&G in the AQMP (EG&G 1992m).

- The DOE proposed plan for new samplers and new sampler locations documented in *Assessment and Integration of Radioactive Ambient Air Monitoring at Rocky Flats Plant* (EG&G 1993u) should be implemented before significant progress is made on RFP remedial activities or mission transition and D&D.

- Determine base-line concentrations of metals, VOCs, SVOCs, and pesticides identified in the PPCD List II (DOE 1991a) for the Industrial Area. The

justifications for establishing these base-line concentrations include (1) the new Colorado CAA for the regulation and control of many of these constituents, (2) establishment of base-line ambient air conditions to be used for risk assessment, and (3) the need to address an apparent data gap for RFP concerning chemicals that were historically used and never quantified in the air medium.

- Measure ambient concentrations of VOCs in the Industrial Area at samplers to the north, south, east, and west of the Industrial Area fence line to characterize the facility with base-line data before remedial or nonroutine activities are conducted. These samplers should be co-located with existing RAAMP samplers S-04, S-07, S-16, and S-100.

- Based on current or future activities, conduct additional air dispersion modeling to determine whether other areas outside the Industrial Area should be monitored.

- Procedures outlined in the *PPCD* (DOE 1991a) should be followed for all remedial and nonroutine activities performed at RFP. The PPCD should be revised as necessary during remedial and D&D activities.

11.7 MAJOR FINDINGS - INCIDENTAL AND FOUNDATION DRAIN WATERS

Incidental waters are defined by RFP as any waters that originate from one or more of the following sources: excavation sites, pits, trenches or ditches, collection of water in secondary containments or berms, process waste valve vaults, electrical vaults, steam pits and other utility pits, telephone manholes, fire suppression system discharges, the natural collection of precipitation, and storm water runoff. For purposes of this IM/IRA/DD, discharges from foundation drains and building sumps are also included as incidental waters.

The following three existing programs relate to incidental waters and foundation drain waters at RFP:

- The Surface Water Management Program provides a long-term program for surface water management and disposition.

- The Storm Water Program handles waters that originate from a precipitation event. This program was discussed in Section 5.0.

- The Control and Disposition of Incidental Waters Procedures control the disposition of incidental waters originating from construction activities, natural collection on the ground surface, collection of water in secondary containment systems, pits, vaults, and the discharge of water from the Fire Suppression System.

No specific management program for foundation drain and building sump waters currently exists.

Surface water is managed in different manners depending on the source. Process waste water is treated at the Building 374 treatment facility; nonindustrial waste water is treated at the sanitary waste treatment plant that discharges into the B-series ponds and ultimately to Walnut Creek. All treated sanitary wastewater, storm water runoff, and some shallow groundwater discharge is stored in the series of ponds on the eastern side of the plant before discharging into Big Dry Creek.

Nineteen of the 90 nonstorm water discharge locations are foundation drains and building sumps in approximately 20 buildings, and the other 71 are utility pits (Hayes 1993a).

Approximately 20 valve vaults are located in the Industrial Area. These vaults may collect groundwater, storm water, and water that may have leaked from the process waste system pipelines.

Foundation drains, sumps, valve vaults, and other structures may intersect the groundwater table. When the water table is high, the potential exists for waters to come in contact with building contaminants and transport the contaminants outside the building as the water table lowers. Some of the RFP buildings, including Buildings 774, 776, and 881, have experienced groundwater problems (EG&G 1993z).

The majority of the foundation drains in the Industrial Area currently discharge directly into the environment via the storm sewer system. These outfalls are usually found on hillsides discharging to a drainage area and then joining the surface water system. Several of the foundation drain discharges are monitored under the surface water sampling program as non-storm water discharges.

The CDIW does not include procedures concerning foundation drains or building sump waters and generally does not require in-depth sampling and analysis for metals, specific radionuclides, or organics. Therefore, the presence of specific COPCs is not known.

A complete understanding and characterization of incidental waters including foundation drain waters does not currently exist. Major data gaps include the volume of flow at specific foundation drain locations, a lack of information on specific contaminants, and poor sampling coverage of foundation drain locations.

Some uncertainty exists concerning where foundation drains actually originate and daylight. This uncertainty is particularly a problem with Buildings 371, 771, 865, and 991.

The final destination of the water from some of the building sumps is not known. Some, but not all, of the building sumps are routed to the process waste system.

In some areas, the foundation drain sampling locations suddenly went dry. This condition may be a result of construction activities in the area, capping, or rerouting the pipes, but this has not been documented.

11.8 RECOMMENDATIONS - INCIDENTAL AND FOUNDATION DRAIN WATERS

The following list contains major recommendations for incidental and foundation drains:

- Include foundation drain/building sump waters as part of the CDIW if they will not be addressed in the draft NPDES permit.

- Revise the frequency and analyte list for foundation drain monitoring to determine a baseline for the entire RFP TCL and TALs as well as to determine the quantity and flow rates of the foundation drain and building sump waters.

- Update the current incidental water monitoring procedures to include TTO as a standard sampling parameter.

- Verify the origins and daylight locations of all foundation drains as well as any possible connections to other piping systems.

- Improve the documentation and record keeping for the incidental water program including dates, volumes, locations, and water quality data.

- Use the appropriate water treatment facilities and methods for the constituents found in the individual incidental, foundation drain, and building sump waters.

- Investigate potential portable packaged treatment and pretreatment facilities capable of handling the expected volume, type, and concentrations of the incidental and foundation drain waters.

- Monitor incidental water and foundation drain water quality and flow conditions during D&D or other nonroutine activities for the entire COPC list identified in the subbasin where the activities are occurring.

11.9 FINDINGS AND RECOMMENDATIONS - DECONTAMINATION AND DECOMMISSIONING ACTIVITIES

Transition of RFP facilities will be completed before D&D activities begin. Transition includes the removal of nonfixed materials and wastes from buildings and equipment, including tanks and piping. D&D activities will follow transition and include removal of fixed contaminants and wastes, fixed equipment, tanks and piping, and building demolition. It is also possible that buildings will be constructed to facilitate D&D activities. Activity-specific health and safety and environmental monitoring will be performed during D&D activities. These types of monitoring, referred to as D&D monitoring, were not considered in this IM/IRA/DD. Verification monitoring, designed to verify constituent concentrations detected by D&D monitoring, is discussed in this document.

Based on information reviewed during preparation of this IM/IRA/DD, little detail concerning specific D&D activities has been published. Because details are not known, specific recommendations for verification monitoring cannot be made. The remainder of this section summarizes the general findings, assumptions, conclusions, and recommendations included in Section 9.0 of this report.

D&D work plans will be developed based on (1) specific activities, (2) COPCs known or expected at the facility where the activities will be performed, and (3) potential

contaminant transport pathways. An approach to preparing a list of COPCs specific to D&D activities was described in Section 9.0. Potential contaminant transport pathways were identified in the future conceptual site model (Section 10.0).

D&D plans and procedures will be similar to those followed during transition and will reflect lessons learned during transition. Engineering and administrative controls will be developed for D&D activities based on identified COPCs and transport pathways in an effort to prevent releases and control release migration outside the Industrial Area.

Environmental monitoring to detect and measure potential releases during D&D consist of a combination of the existing RFP monitoring network and additional samplers designed to meet specific needs related to the activities planned. Evaluation of the current monitoring network found that the current system represents the best available technologies and adequate instrumentation for the monitoring of radiological and nonradiological constituents of concern.

The existing samplers or sampling procedures may be revised to better characterize activity-specific conditions. For example, analytical procedures for filters from RAAMP samplers near a building demolition site may be changed to provide results faster than the current procedures allow. Additional samplers will be located in areas not covered by the current network, will have improved sensitivity over existing samplers, or will measure COPCs not detected by the existing samplers.

The existing RFP emergency response program was evaluated and found to be more than adequate. The RFP EPLAN establishes the planning, preparedness, and response concepts for emergencies at the plant. The goals of the EPLAN are to protect the health and safety of onsite personnel and the public, limit damage to facilities and equipment, minimize impact to onsite operations and security, and limit adverse impacts on the environment (EG&G 1993w). This plan also includes a set of procedures for identifying and responding to a release or occurrence. D&D activity-specific response levels should

be incorporated into the RFP occurrence reporting program and should be followed during D&D.

Activity-specific safety hazards and precautions can be identified by preparing an integrated work package. This process ensures the equipment, structures, systems, and components required for a task are free from any deficiencies or modifications.

It is also important to determine criteria for conditions that will require an investigation in response to elevated contaminant levels detected during verification monitoring. Action levels should be established from media-specific base-line concentrations measured before starting D&D activities and communicated to the analyzing laboratory. By informing the laboratory of the action levels, source investigations can begin soon after it has been determined that the concentration measured exceeds the action level concentrations (EG&G 1993w).

(intentionally blank)

NOTICE:

INCOMPLETE DOCUMENT

This document was distributed in an incomplete state, and the microform copy is representative of the paper copy. Section 12.0 was not listed in the Table of Contents. If replacement pages are distributed, they will be microfilmed and included in the Administrative Record file.

The Adminstrative Record Staff

12.0 REFERENCES

Ackerman, H.D. 1974. Shallow seismic compressional and shear wave refraction and electrical resistivity investigations at Rocky Flats, Jefferson County, Colorado: *U.S. Geological Survey Journal of Research*, v. 2, no. 4, p. 421-430.

Advanced Sciences, Inc. 1993. Prepared for EG&G Rocky Flats Inc. *Storm Water NPDES Permit - Application Monitoring Program, Rocky Flats Plant Site.*

Advanced Sciences, Inc. 1991a (September 30). Prepared for EG&G Rocky Flats Inc. *Sanitary Sewer Infiltration/Inflow and Exfiltration Study*. Rocky Flats Plant Site, Task 1 of the Zero-Offsite Water-Discharge Study. 48 p., 10 tables, 24 figures, and three appendices (A through C).

Advanced Sciences, Inc. 1991b (September). *Sanitary Sewer Infiltration/Inflow and Exfiltration Study: RFP: Task 1 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1991c (September). *Non-Point Source Assessment and Storm-Sewer Infiltration/Inflow and Exfiltration Study: RFP: Tasks 2&3 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1991d (January). *Solar Ponds Interceptor Trench System: Groundwater Management Study, RFP: Task 7 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1991e (January). *Sanitary Treatment Plant Evaluation Study: RFP: Task 10 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1991f (May). *Reverse Osmosis and Mechanical Evaporation Study: RFP: Task 12 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1991g (May). *Surface Water Evaporation Study: RFP: Task 15 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1991h (June). *Alternatives to Zero Discharge: RFP: Task 17 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1991i (June). *Report on Drain Investigations: RFP: Task 18 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1991j (March). *Raw, Domestic and Industrial Water Pipeline Leak-Detection Method Study: Task 20 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1991k (February). *Temporary Water Storage Capabilities Study: Task 21 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1991l (May). *Feasibility of Groundwater Cutoff/Diversion Study: Task 26 of the Zero-Offsite Water-Discharge Study.*

Advanced Sciences, Inc. 1988 (September). *Water Management Alternatives for the Rocky Flats Plant.*

Arbuckel, J. Gordon, Mary Elizabeth Bosco, David R. Case, Elliott P. Laws, John C. Martin, Marshall Lee Miller, Russell V. Randle, Richard G. Stoll, Thomas F.P. Sullivan, Timothy A. Vanderver, Jr., and Paul A.J. Wilson. 1989 (March). *Environmental Law Handbook.* Tenth Edition, Government Institutes, Inc. Rockville, MD.

Boulder County Planning Commission. 1983. *Boulder County Comprehensive Plan - Geology Element*; Boulder County Land Use Department.

Code of Federal Regulations. Clean Air Act 40 CFR 50-80. Revised as of July 1, 1992. Office of the Federal Register National Archives and Records Administration.

Colorado Council on Rocky Flats. 1993 (January). *The Handbook on Rocky Flats.*

Colorado Department of Health. Published Monthly. Environmental Surveillance Report on the U.S. Department of Energy Rocky Flats Plant.

Colorado Department of Health. 1993a (October 26). Minutes of Exchange of Information Meeting, Rocky Flats Plant Environmental Surveillance.

Colorado Department of Health. 1993b (May). Prepared by ChemRisk. *Project Task 6, Exposure Pathway Identification and Transport Modeling, Draft Report.*

Colorado Department of Health. 1993c (October). Prepared by ChemRisk. *Project Task 8, Dose Assessment for Historical Contaminant Releases from Rocky Flats, Volumes 1 and 2.*

Colorado Department of Health. 1992 (August). Prepared by ChemRisk. *Reconstruction of Historical Rocky Flats Operations & Identification of Release Points, Project Tasks 3 & 4.* Health Studies on Rocky Flats. Phase I: Historical Public Exposures.

Conroy, Bartley. 1989 (August). "Design and Engineering of the UMTRA Mobile Waste Treatment Plant." Paper presented at the annual meeting of AIChE, Philadelphia. August 20 to 23, 1989.

Dames and Moore. 1981. *Geologic and Seismologic Investigations for Rocky Flats Plant.* Contract DE-AC04-80A110890.

EG&G Rocky Flats, Inc. 1994a (issued monthly). *Monthly Environmental Monitoring Report*. Rocky Flats Plant, Environmental Protection Management Department, Environmental Protection and Waste Reporting.

EG&G Rocky Flats, Inc. 1994b (February 18). *Air Quality Division Management Plan.*

EG&G Rocky Flats, Inc. 1994c (January 5). *Activity Control Envelope Development.* 2-D55-TSIP-001. Revision 0.

EG&G Rocky Flats, Inc. 1993a (November 12). *Draft Final Well Evaluation Report.*

EG&G Rocky Flats, Inc. 1993b. *Deep Seismic Report.*

EG&G Rocky Flats, Inc. 1993c. *Rocky Flats Plant Site Environmental Report, January through December 1992.*

EG&G Rocky Flats, Inc. 1993d (November). M. Litaor of EG&G Rocky Flats, Inc. Personal communication with Dan Schultz of Jacobs Engineering Group Inc.

EG&G Rocky Flats, Inc. 1993e (June 16). *FY93 Systems Engineering Analysis (SEA) Facility Characterization and Inventory Report.*

EG&G Rocky Flats, Inc. 1993f (December 7). Waste Stream and Residue Identification and Inventory (WSRIC) Database.

EG&G Rocky Flats, Inc. 1993g (December 7). Waste and Environmental Management System (WEMS) Database.

EG&G Rocky Flats, Inc. 1993h (November 13). Chemical Tracking and Control Chemical Inventory Database.

EG&G Rocky Flats, Inc. 1993i (November). Barry Roberts of EG&G Rocky Flats. Personal communication with Susan Wyman and Theresa Jehn-Dellaport of Jacobs Engineering Group Inc.

EG&G Rocky Flats, Inc. 1993j (November). *Groundwater Protection and Monitoring Program Plan.*

EG&G Rocky Flats, Inc. 1993k (March). *Draft Final Technical Memorandum No. 8, Revised Phase II RFI/RI Work Plan (Bedrock), Rocky Flats Plant 903 Pad, Mound, and East Trenches (Operable Unit No. 2).*

EG&G Rocky Flats, Inc. 1993l. *Annual RCRA Groundwater Monitoring Report for Regulated Units at Rocky Flats Plant.* (Issued annually.)

EG&G Rocky Flats, Inc. 1993m. *Event-related Surface-Water Monitoring Report: Rocky Flats Plant for Water Years 1991 and 1992.*

EG&G Rocky Flats, Inc. 1993n (January). *Rocky Flats Plant Surface-Water and Sediment Monitoring Program Summary.*

EG&G Rocky Flats, Inc. 1993o. Greg Weatherbee, EG&G Surface Water Division. Personal communication.

EG&G Rocky Flats, Inc. 1993p. Bob Fiehweg, EG&G Surface Water Division. Personal communication.

EG&G Rocky Flats, Inc. 1993q. *Environmental Applications of Radio-based Telemetry for Surface Water Monitoring.*

EG&G Rocky Flats, Inc. 1993r. Les Goodwin, EG&G Surface Water Division. Personal communication.

EG&G Rocky Flats, Inc. 1993s. Ed Moritz, EG&G Surface Water Division. Personal communication.

EG&G Rocky Flats, Inc. 1993t (September 30). *Background Geochemical Characterization Report.*

EG&G Rocky Flats, Inc. 1993u (September). *Assessment and Integration of Radioactive Ambient Air Monitoring at Rocky Flats Plant.*

EG&G Rocky Flats, Inc. 1993v. *Draft Rocky Flats Plant Radionuclide Air Effluent Emissions Monitoring Program Plan.* RCN-040-93

EG&G Rocky Flats, Inc. 1993w (June 30). *Rocky Flats Plant Emergency Plan.* 1-64000-EP-01.00.

EG&G Rocky Flats, Inc. 1993x. *Environmental Protection Management Plan.*

EG&G Rocky Flats, Inc. 1993y (September). *Control and Disposition of Incidental Waters.*

EG&G Rocky Flats, Inc. 1993z (November 10). Bill Hayes, EG&G Surface Water Division. Telephone conversation with T.C. Wait of Jacobs Engineering Group Inc. concerning incidental waters and sampling procedures.

EG&G Rocky Flats, Inc. 1993aa (December 6). Frank Gibbs, EG&G Building 559/560 manager. Field conversation with Mike Visocky, David Landes, T.C. Wait, and Theresa Jehn-Dellaport of Jacobs Engineering Group Inc. concerning Building 559 foundation drain and "green hose."

EG&G Rocky Flats, Inc. 1993bb (December 2). Mark Burmeister, EG&G OU1 Treatment Facility. Telephone conversation with T.C. Wait of Jacobs Engineering Group Inc. about Building 881 foundation drains.

EG&G Rocky Flats, Inc. 1993cc. Ron Henry, Surface Water Division. Incidental Water Logs, 1990 to 1993.

EG&G Rocky Flats, Inc. 1993dd (December 19). Leslie Dunstan, EG&G Surface Water Division. Office visit with David Landes and Mike Visocky of Jacobs Engineering Group Inc. concerning the RFP foundation drains.

EG&G Rocky Flats, Inc. 1993ee (December 12). Leslie Dunstan, EG&G Surface Water Division. Telephone conversation with David Landes of Jacobs Engineering Group Inc. concerning the sampling program for foundation drains and building sumps.

EG&G Rocky Flats, Inc. 1993ff (December 2). Russ Cirillo, EG&G OU1 Treatment Facility. Telephone conversation with T.C. Wait of Jacobs Engineering Group Inc. concerning 881 foundation drain flow data.

EG&G Rocky Flats, Inc. 1993gg (June 1). Dean Yashan, EG&G Surface Water Division. Memorandum to Bob Stevens concerning the proposed response to the May 13, 1993 "Management of Foundation Drain and Utility Pit Water" letter from M.S. Karol to T.G. Hedahl.

EG&G Rocky Flats, Inc. 1993hh (November 4). Cat Butz, EG&G Surface Water Division. Office visit with T.C. Wait of Jacobs Engineering Group Inc. concerning the drain identification study and dye testing.

EG&G Rocky Flats, Inc. 1993ii (January). *Operational Safety Analysis (OSA) for Building 910 Evaporators.*

EG&G Rocky Flats, Inc. 1993jj (November 16). Craig Cowdry, EG&G OU2 Treatment Facility. Telephone conversation with T.C. Wait of Jacobs Engineering Group Inc. about the primary treatment facilities at Rocky Flats.

EG&G Rocky Flats, Inc. 1993kk (November 16). Carrie Wesley, EG&G Building 374 assistant manager. Telephone conversation with T.C. Wait of Jacobs Engineering Group Inc. regarding 374 evaporators.

EG&G Rocky Flats, Inc. 1993ll (December 1). Rick Wagner, EG&G Building 774 manager. Telephone conversation with Mike Visocky of Jacobs Engineering Group Inc. concerning Building 774 foundation drains, tanks, and sumps.

EG&G Rocky Flats, Inc. 1993mm (November 19). Frank Huffman, EG&G Sewage Treatment Plant Shift Manager. Site visit and conversation with David Landes of Jacobs Engineering Group Inc. about the sewage treatment plant (Building 995).

EG&G Rocky Flats, Inc. 1993nn (October 21). Mark Burmeister and R. Cirillo, EG&G OU1 Treatment Facility. Field site visit and conversation with T.C. Wait of Jacobs Engineering Group Inc. regarding OU1 treatment facility.

EG&G Rocky Flats, Inc. 1993oo (December 9). Georgene Porter, EG&G Authorized Classifier. Telephone conversation and office meeting with Farrel Hobbs of Jacobs Engineering Group Inc. concerning the classification of Building 460 outfall and sewage treatment plant detectors.

EG&G Rocky Flats, Inc. 1993pp (December 1). Steve Barros, EG&G Surface Water Division. Plant site walk and conversations with David Landes, Mike Visocky, and T.C. Wait of Jacobs Engineering Group Inc. regarding foundation drain sampling locations.

EG&G Rocky Flats, Inc. 1993qq (December 2). Sharon Wilson, EG&G Building 991 manager. Telephone conversation with T.C. Wait of Jacobs Engineering Group Inc. about Building 991 foundation drain.

EG&G Rocky Flats, Inc. 1993rr (December 22). Kyle Peter, RCRA Regulatory Programs. Telephone conversation with Eric Mende of Wright Water Engineers concerning water treatment processes and saltcreting operations in Buildings 374 and 774.

EG&G Rocky Flats, Inc. 1993ss (September). *Rocky Flats Plant Transition Status Report.*

EG&G Rocky Flats, Inc. 1993tt (July 30). *Rocky Flats Plant Site-wide Environmental Compliance Program Management Plan.*

EG&G Rocky Flats, Inc. 1993uu. *RFP Policy Manual.*

EG&G Rocky Flats, Inc. 1993vv. *Planning and Preparedness for Operational Emergencies.*

EG&G Rocky Flats, Inc. 1993uu (September). *Rocky Flats Plant Transition Status Report.*

EG&G Rocky Flats, Inc. 1992a (October 1). *RFP Mission Transition Program Management Plan.*

EG&G Rocky Flats, Inc. 1992b. *Final Environmental Monitoring Plan.*

EG&G Rocky Flats, Inc. 1992c (March). *Phase II Geologic Characterization - Data Acquisition Surface Geologic Mapping of the Rocky Flats Plant and Vicinity, Jefferson and Boulder Counties, Colorado.* Final Report.

EG&G Rocky Flats, Inc. 1992d (September 30). *Final Background Geochemical Characterization Report, Rocky Flats Plant*, Golden, Colorado.

EG&G Rocky Flats, Inc. 1992e. *Operating Procedures, Vol. II, Groundwater.* No. 521000, SOPS-GW, Environmental Management Department.

EG&G Rocky Flats, Inc. 1992f. *Historical Release Report*, The Rocky Flats Plant, Golden, Colorado, Environmental Restoration Program.

EG&G Rocky Flats, Inc. 1992g (April). *Draft Environmental Restoration Technical Support Document (ERTSD): A NEPA Support Document For the Rocky Flats Plant.*

EG&G Rocky Flats, Inc. 1992h (November 19). *Phase II RFI/RI Aquifer Test Report, 903 Pad, Mound, and East Trenches Areas (Operable Unit No. 2).*

EG&G Rocky Flats, Inc. 1992i. Prepared by Wright Water Engineers. *Draft Surface Water Management Plan.*

EG&G Rocky Flats, Inc. 1992j (April 1). *1989 Surface-Water and Sediment Geochemical Characterization Report.*

EG&G Rocky Flats, Inc. 1992k. *1990 Surface-Water and Sediment Geochemical Characterization Report.*

EG&G Rocky Flats, Inc. 1992l. *Evaluation of the Rocky Flats Surface-Water and Sediment Monitoring Programs.*

EG&G Rocky Flats, Inc. 1992m (November). *Rocky Flats Plant Air Quality Management Plan* (AQMP).

EG&G Rocky Flats, Inc. 1992n. *Environmental Management Division Operating Procedures - Volume VI; Air.*

EG&G Rocky Flats, Inc. 1992o (December). *Operational Safety Analysis (OSA) for Building 374 Evaporators.*

EG&G Rocky Flats, Inc. 1992p (April). *Proposed IM/IRA/DD for the Solar Evaporation Ponds - OU4.*

EG&G Rocky Flats, Inc. 1992q (December 22). A.L. Schubert, EG&G Waste Programs. Memorandum written to R.V. Morgan of EG&G Waste Operations concerning specific organic guidelines for the Building 374 evaporators.

EG&G Rocky Flats, Inc. 1991a. *Rocky Flats Plant Site Environmental Monitoring Report, January through December 1991,* RFP-ENV-91.

EG&G Rocky Flats, Inc. 1991b (July 31). *Rocky Flats Plant Phase I Geologic Characterization Report.*

EG&G Rocky Flats, Inc. 1991c (November 27). *Final Groundwater Protection and Monitoring Program Plan for Rocky Flats Plant,* in compliance with DOE Order 5400.1, nine sections, one plate, 31 figures, 20 tables, and Appendices A through E.

EG&G Rocky Flats, Inc. 1991d. *Rocky Flats Plant Site Environmental Report for 1990.* RFP-ENV-90, 210 p., 39 figures, 55 tables.

EG&G Rocky Flats, Inc. 1991e (October). *Assessment of Known, Suspect and Potential Environmental Releases of Polychlorinated Biphenyls (PCBs).* Environmental Management Department.

EG&G Rocky Flats, Inc. 1991f (May). *Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA Remedial Investigations/Feasibility Studies and RCRA Facility Investigations/Corrective Measures Studies Activities.*

EG&G Rocky Flats. 1991g. *Preliminary Geochemical Analysis of Groundwater and Surface Water in Seepage Areas along the Mesa, East of Operable Unit 2.*

EG&G Rocky Flats, Inc. 1991h (November). *Catalogue of Monitoring Activities.*

EG&G Rocky Flats, Inc. 1991i (May). *Sampling and Analysis Plan, Surface Water IM/IRA, South Walnut Creek Basin OU2, Granular Activated Carbon Treatment System.*

EG&G Rocky Flats, Inc. 1991j (August). *Work Plan for Field Treatability Study, South Walnut Creek Basin Surface Water IM/IRA.*

EG&G Rocky Flats, Inc. 1990 (January 3). *Draft Geologic Characterization Report.*

EG&G Rocky Flats, Inc. 1989. Draft summary of March 15, 1989 meeting, concerning Rocky Flats Plant air effluent monitoring.

EG&G Rocky Flats, Inc. 1987 (June). *Final Safety Analysis Report - Building 774.*

Freeze, R. Allan and John A. Cherry. 1979. *Groundwater.* Prentice-Hall, Inc. Englewood Cliffs, NJ.

Hayes, Bill. 1993 (April). *Non-Storm Water Discharge Locations and Sampling at Rocky Flats.*

Hoffman, Nancy D. 1981 (December 17). *Water Quality Data for Foundation Drains and Building Sumps from 1977 through 1981.* (Draft) 6 p. plus tables.

Hurr, R.T. 1976 (March). *Hydrology of Nuclear-Processing Plant Site, Rocky Flats, Jefferson County, Colorado.* Open File Report 76-268. USGS, Denver, Colorado.

IT Corporation. 1990 (November). *Evaluation of Treatment Alternatives for Storm Water in Ponds A-4, B-5, and C-2: Final Report.*

Jacobs Engineering Group Inc. 1993a. Prepared for EG&G Rocky Flats, Inc. *Draft Integrated Field Sampling Plan.*

Jacobs Engineering Group Inc. 1993b (March). *Final Phase Work Plan for OU9.*

Keddy, Michael. 1989 (September). *Summary of Technologies for Remediation of Aquifers.* Los Alamos National Laboratories.

LeRoy, L.W. and R.J. Weimer. 1971. "Geology of the Interstate 70 Roadcut, Jefferson County, Colorado." Colorado School of Mines Prof. Contribution No. 7.

Los Alamos National Laboratory. 1992a (November). *Installation Work Plan for Environmental Restoration Clean-up Program.* Vol. 1.

Los Alamos National Laboratory. 1992b (November). *Installation Work Plan for Environmental Restoration Clean-up Program.* Vol. 2.

Los Alamos National Laboratory. 1986 (February). *Low-Level Integrated System Test.*

Lovering, T.S. 1929. Geologic History of the Front Range, Colorado: Colorado Scientific Society Proceedings, v.12, n.4, p. 59-111.

Morgan, R.E. 1990 (December). *Environmental Constituents in the Rocky Flats Area - Non-Facility Related Sources Pertinent to Water Quality.*

Moritz, E.J. and J. Olthos. 1992 (September). *Microstrainer Pilot Testing of Rocky Flats Plant Terminal Ponds A-4, B-5, and C-2.*

Moritz, E.J., C.R. Hoffman, and T.R. Hergert. 1992 (December). *Water Treatment Filter Bag Efficiency, Capacity, and Tensile Testing.*

Morrison Knudsen Corporation. 1993 (December 17). *A Revised Approach to Implementation of IM/IRAs at Rocky Flats* (White Paper).

Nyhan, John. 1989 (February). *Analysis of Precipitation Occurrences in Los Alamos, New Mexico, for Long-Term Predictions of Waste Repository Behavior.* Los Alamos National Laboratory.

Oliviera, R.B.B. de. 1975. Exploration for buried channels by shallow seismic refraction and resistivity and determination of elastic properties at Rocky Flats, Jefferson County, Colorado: Golden, Colorado School of Mines, unpublished M.S. thesis T-1718, 131 p.

Reichart, S.O. 1953. Geology of the Golden-Green Mountain area, Jefferson County, Colorado: Colorado School of Mines, Ph.D. thesis.

Robson, S.G. 1983. *Hydraulic Characteristic of the Principal Bedrock Aquifers in the Denver Basin, Colorado*: U.S. Geological Survey Hydrologic Investigations Atlas HA-659, scale 1:500,000, three sheets.

Robson, S.G., Andrew Wacinski, Stanley Zawistowski, and John C. Romero, 1981. Geologic structure, hydrology, and water quality of the Laramie-Fox Hills aquifer

in the Denver Basin, Colorado, U.S. Geological Survey Hydrogeologic Investigations Atlas HA-650, 1:500,000, three sheets.

Rockwell International. 1989. *RCRA Closure Plan Tanks T-40, T-66, T-67, T-68, Hazardous Waste Management Unit.*

Rockwell International. 1986. *Annual Environmental Monitoring Report, January-December 1985.* Golden, Colorado: Rockwell International, Rocky Flats Plant, Report RFP-ENV-85, 1986.

Schleicher and Schuell. 1982 (March). Publication No. 500, "Innovative Products for Separation Science."

Science Applications International Corporation. 1993 (January 21). *Development and Testing of One-Sun Photo Reactor for Catalytic Detoxification of Water Using Solar Energy.*

Scott, G.R. 1963. "Quaternary Geology and Geomorphic History of the Kassler Quadrangle, Colorado," U.S. Geological Survey Professional Paper 421-A.

Scott, G.R. 1962. Geology of the Littleton quadrangle, Jefferson, Douglas, and Arapahoe Counties, Colorado: U.S. Geological Survey Bulletin 1121-L, p. L1-L53.

Scott, G.R. 1961. Preliminary geologic map of the Indian Hills quadrangle, Jefferson County, Colorado: U.S. Geological Survey Miscellaneous Geological Investigations Map I-333, scale 1:24,000.

Scott, G.R. 1960. "Quaternary Sequence East of the Front Range Near Denver, Colorado," U.S. Geological Survey Professional Paper 700-C, pp. C11-C18, 1970.

Spencer, F.D. 1961. "Bedrock Geology of the Louisville Quadrangle, Colorado," U.S. Geological Survey Geologic Quadrangle Map GQ-151.

U.S. Department of Energy. 1994 (January). *Decontamination and Decommissioning Guidance Document, Draft 3.* Office of Environmental Restoration (EM-40).

U.S. Department of Energy. 1993 (February). *Annual Report for Treatability Studies at Rocky Flats Plant, Fiscal Year 1992.*

U.S. Department of Energy. 1992a (July). *Rocky Flats Transition Plan, Report to Congress.*

U.S. Department of Energy. 1992b (December). *Final Phase I RFI/RI Work Plan, Rocky Flats Plant, 700 Area, Operable Unit No. 8.*

U.S. Department of Energy. 1992c. *Final Surface Water Interim Measures/Interim Remedial Action Plan/Environmental Assessment and Decision Document for South Walnut Creek Basin, Operable Unit No. 2.*

U.S. Department of Energy. 1992d. *Final Proposed Interim Measure/Interim Remedial Action Decision Document for the Solar Evaporation Ponds, Operable Unit No. 4.*

U.S. Department of Energy. 1992e (October). *Application to the Environmental Protection Agency for Authorization to Discharge Under the National Pollution Discharge Elimination System.*

U.S. Department of Energy. 1992f (March). *Annual Report for Treatability Studies at Rocky Flats Plant, Fiscal Year 1991.*

U.S. Department of Energy, U.S. Environmental Protection Agency Region VIII, and the State of Colorado. 1991 (January 22). Interagency Agreement. Docket No. 91-01-22-01. Denver, Colorado.

U.S. Department of Energy. 1991a (November). *Final Plan for Prevention of Contaminant Dispersion* (PPCD). Rocky Flats Plant. Golden, Colorado.

U.S. Department of Energy. 1991b (January 22). *Rocky Flats Interagency Agreement.*

U.S. Department of Energy. 1991c (May). *Engineering Evaluation/Cost Analysis for the Proposed Management of Contaminated Structures at the Weldon Spring Chemical Plant.* Oak Ridge Operations Office.

U.S. Department of Energy. 1990. *1989 Population, Economic and Land Use Data Base for Rocky Flats Plant, Golden, Colorado.*

U.S. Department of Energy. 1988 (September 26). DOE Order 5820.2A. *Radioactive Waste Management.* Chapter V - Decommissioning of Radioactivity Contaminated Facilities.

U.S. Department of Energy. 1987 (December 15). RCRA Part B Operating Permit Application for U.S. DOE-Rocky Flats Plant, Hazardous and Radioactive Mixed Wastes. CO7890010526, Revision 1.

U.S. Department of Energy. 1980. *Final Environmental Impact Statement: Rocky Flats Plant Site, Golden, Jefferson County, Colorado.* Volumes 1, 2, and 3, Washington, D.C., DOE/EIS-0064.

U.S. Environmental Protection Agency. 1993a (September). *Environmental Applications of Radio Based Telemetry for Surface Water Monitoring.* SWD-020-93.

U.S. Environmental Protection Agency. 1993b (September). "Demonstration of the Colloid Polishing Filter Method" *EPA Program Fact Sheet*. Golden, Colorado.

U.S. Environmental Protection Agency. 1991 (April). *Guide to Developing Superfund No Action, Interim Action and Contigency Remedy RODs*. Office of Solid Waste and Emergency Responses. Publication 9355.3-02FS-3.

U.S. Environmental Protection Agency. 1990 (September). *Ultrox International Ultraviolet Radiation/Oxidation Technology: Applications Analysis Report*. Cincinnati, Ohio.

U.S. Environmental Protection Agency. 1989a (March). *Guide to Treatment Technologies for Hazardous Wastes at Superfund Sites*. Cincinnati, Ohio.

U.S. Environmental Protection Agency. 1989b. *Risk Assessment Guidance for Superfund - Volume 1, Human Health Evaluation Manual (Part A)*.

U.S. Environmental Protection Agency. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*.

U.S. Environmental Protection Agency. 1983 (January). *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods*. EPA-600/4-77-027a.

U.S. Environmental Protection Agency. 1982 (December 6). 40 CFR Part 50, Appendix B.

U.S. Environmental Protection Agency. 1975 (September). *Guidelines for Air Quality Monitoring Network Design and Instrument Siting*. Office of Air Quality Planning and Standards (OAQPS) No. 1.2-012.

Weimer, R.J. 1973 (July). "A Guide to Uppermost Cretaceous Stratigraphy, Central Front Range, Colorado: Deltaic Sedimentation, Growth Faulting, and Early Laramide Crustal Movement," *The Mountain Geologist*. Volume 10, No. 3, pp. 53-97.

Winger, Eric D. and Lawrence H. Keith Lewis. 1993. *Sampling and Analysis of Airborne Pollutants.*

Wright Water Engineers, Inc. 1994 (January). *Evaluation of the Criteria Governing the Groundwater Protection and Monitoring Program at the Rocky Flats Plant.*

Wright Water Engineers, Inc. 1992 (April). Prepared for EG&G Rocky Flats. *Rocky Flats Plant Drainage and Flood Control Master Plan.*

Yashan, Dean, and Steve Barros. 1992 (November). *A Description of Rocky Flats Foundation Drains.* EG&G Rocky Flats, Golden, Colorado.

(intentionally blank)

NOTICE:

INCOMPLETE DOCUMENT

This document was distributed in an incomplete state, and the microform copy is representative of the paper copy. Plates 4-1 and 4-2 were not listed in the Table of Contents. If replacement pages are distributed, they will be microfilmed and included in the Administrative Record file.

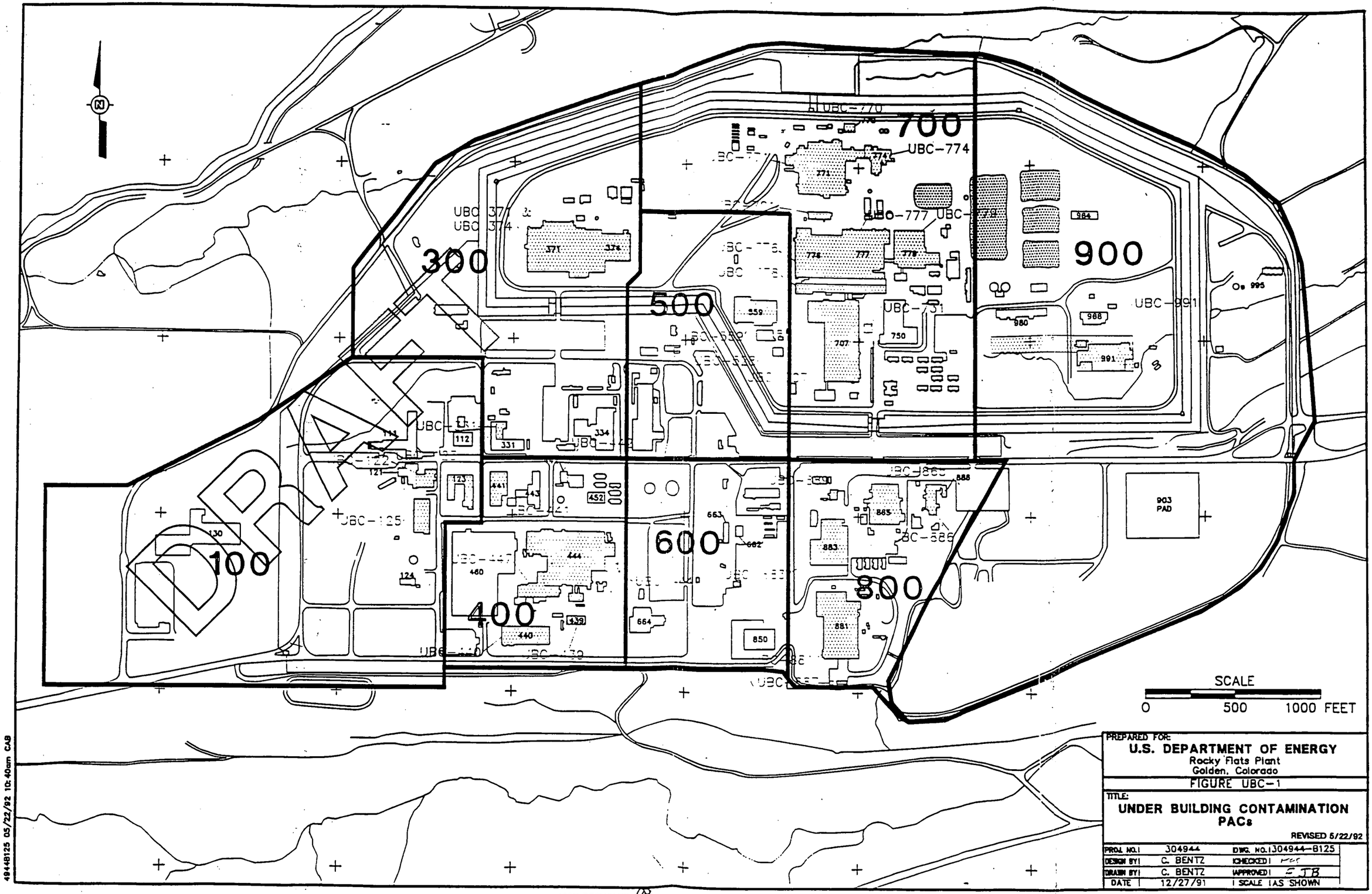
The Adminstrative Record Staff

NOTICE:

INCOMPLETE DOCUMENT

This document was distributed in an incomplete state, and the microform copy is representative of the paper copy. Plate 5-1 was not listed in the Table of Contents. If replacement pages are distributed, they will be microfilmed and included in the Administrative Record file.

The Adminstrative Record Staff



PREPARED FOR:
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

FIGURE UBC-1

TITLE:
UNDER BUILDING CONTAMINATION PACs

REVISED 5/22/92

PROJ. NO.	304944	DWG. NO.	304944-8125
DESIGN BY	C. BENTZ	CHECKED	MEF
DRAWN BY	C. BENTZ	APPROVED	EJB
DATE	12/27/91	SCALE	AS SHOWN

49448125 05/22/92 10:40am CAB

100% RECYCLED

Intentionally Blank

U.S. Department of Energy

Rocky Flats Plant

DRAFT

964 Buildings and Structures

Roads/Fences

N

200 0 400

100 200

SCALE IN FEET

FIGURE 2-5
INDUSTRIAL AREA IM/IRA/DD
Rocky Flats Plant
Industrial Area

EG&G ROCKY FLATS
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

C:\RFLATS\SW\SWFIG25.DWG 05H60300

100% RECYCLED

(intentionally blank)

2086000 2082500 2085000 2087000

752000 750000 747500 747000

U.S. Department of Energy

Rocky Flats Plant

Figure 2-6

Groundwater Monitoring Well Locations

- Paved Roads
- Dirt Roads
- Ponds and lakes
- Buildings and other structures

WELL TYPES

- Background Characterization Wells
- Boundary Wells
- CERCLA Characterization Wells
- RCRA Regulatory Wells
- RCRA Characterization Wells
- Special Purpose Wells

Active Wells

- Bedrock
- Alluvium
- Alluvium/Bedrock

Inactive Wells

- Bedrock
- Alluvium
- Alluvium/Bedrock
- Abandoned Wells

Scale = 1 : 6000
1 inch = 500 feet

0 500

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

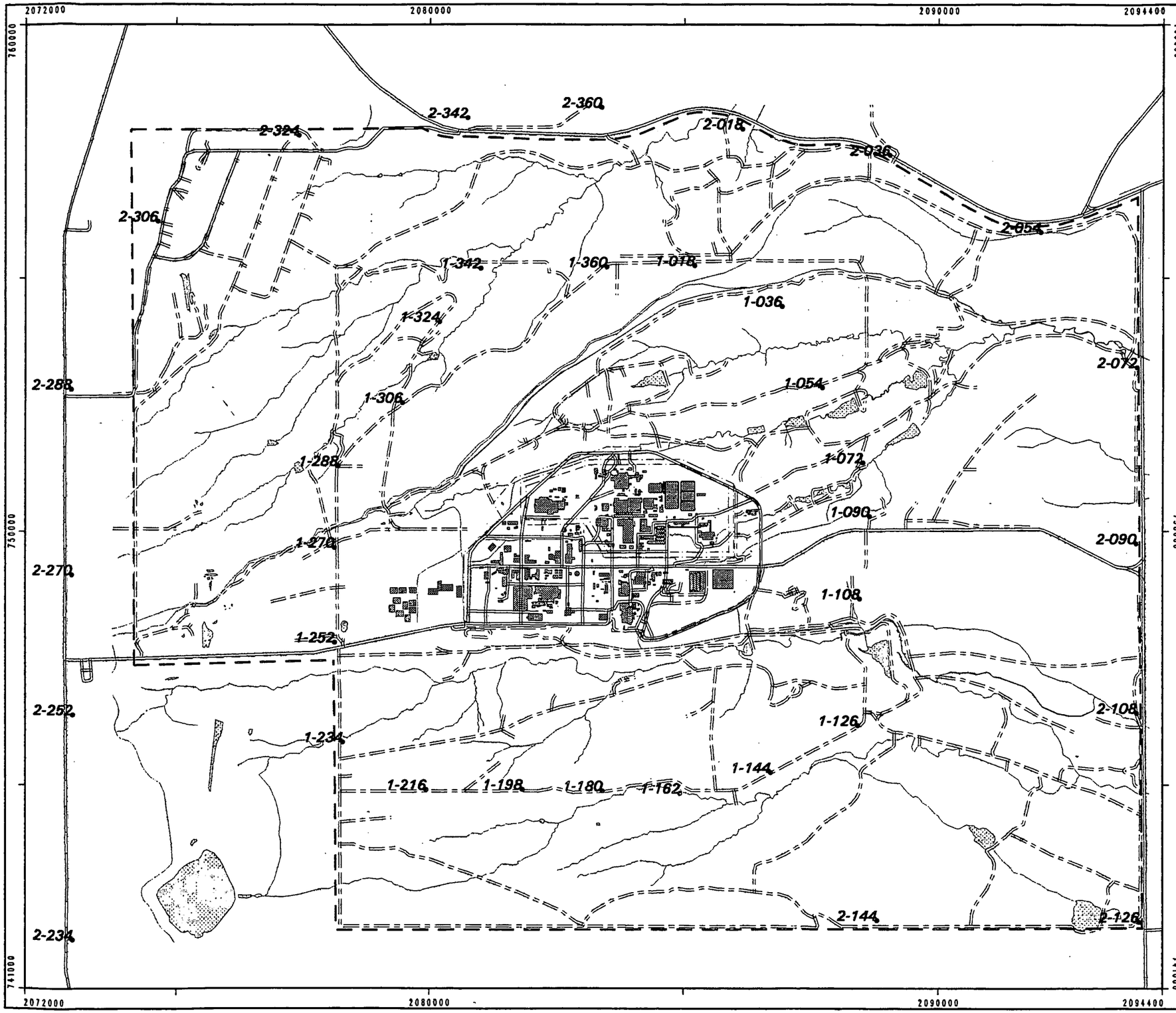
Prepared by:

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

Date: February 11, 1994

(intentionally blank)



U.S. Department of Energy
Rocky Flats Plant

Figure 2-14

Industrial Area IM/IRA/DD
Annual Soil
Sampling Stations

- *Buildings*
- *Lakes and Ponds*
- *Major roads*
- *Paved roads*
- *Dirt roads*
- *Fences*
- *Rocky Flats Plant Boundary*
- *Annual Soil Sampling Locations*

N

Scale = 1 : 24000
1 inch = 2000 feet

0 2000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

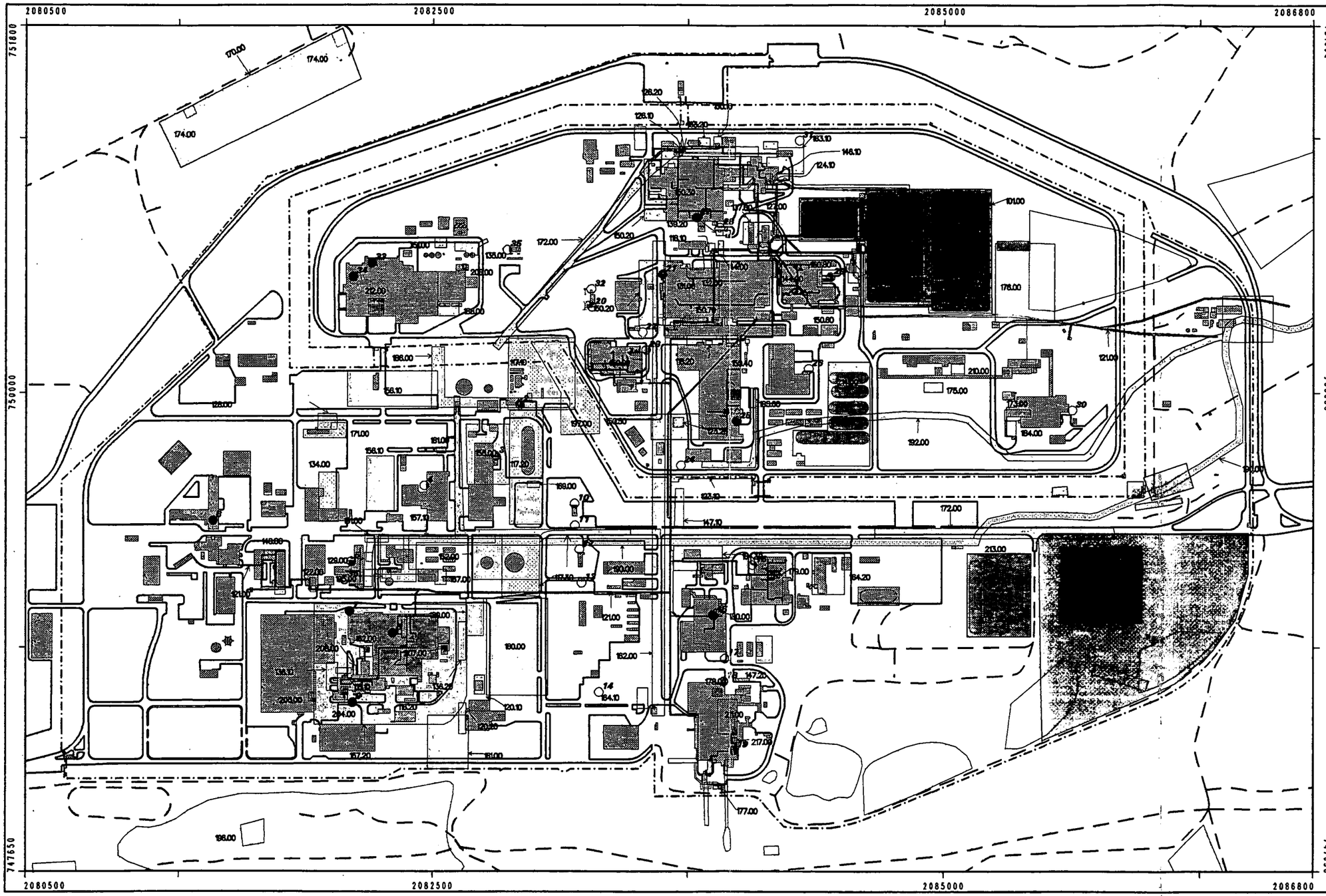
Prepared by:

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

Date: March 02, 1994

(intentionally blank)



U.S. Department of Energy
Rocky Flats Plant

Figure 3-2
Industrial Area IM/IRA/DD
IHSS and PCB Site Location Map

- *Buildings*
- *OU2 IHSS*
- *OU4 IHSS*
- *OU8 IHSS*
- *OU9 IHSS*
- *OU10 IHSS*
- *OU12 IHSS*
- *OU13 IHSS*
- *OU14 IHSS*
- *OU15 IHSS*
- *OU16 IHSS*
- *Paved roads*
- *Dirt roads*
- *Fences*
- *Approximate PCB Site Location In Industrial Area*

--DRAFT--
Source:

Historical Release Report

(EG&G 1992f)

Scale = 1 : 6000
1 inch = 500 feet

0 500

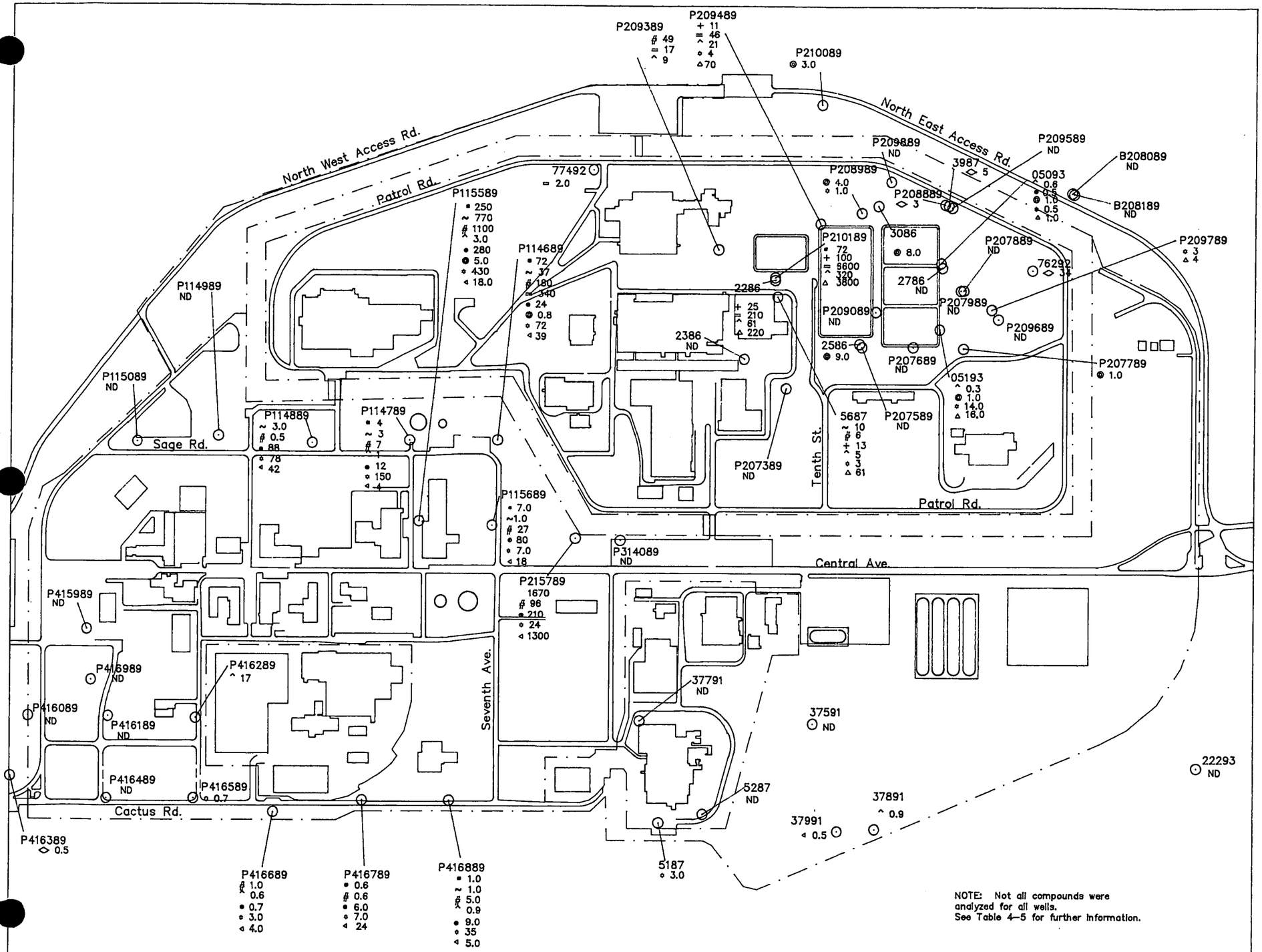
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

Prepared by:
EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

Date: March 08, 1994

(intentionally blank)



c:\rflats\sw\swfig44.dwg 05H60300

U.S. Department of Energy

Rocky Flats Plant

DRAFT

EXPLANATION

- ⊙ Well
- ▪ 72 1,1,1 – Trichloroethane
- ~ 5.0 1,1 – Dichloroethane
- # 6 1,1 – Dichloroethene
- + 13 1,2 – Dichloroethene
- = 210 Carbon Tetrachloride
- ^ 5 Chloroform
- • 0.5 cis – 1,2 – Dichloroethene
- ◎ 9.0 Methylene Chloride
- ∘ 3 Tetrachloroethene
- △ 61 Trichloroethene
- ◇ 21 Other Organic Compounds (See Table 4–5)

Results in micrograms per liter

- Paved Road
- Fence
- Building/Structure

N

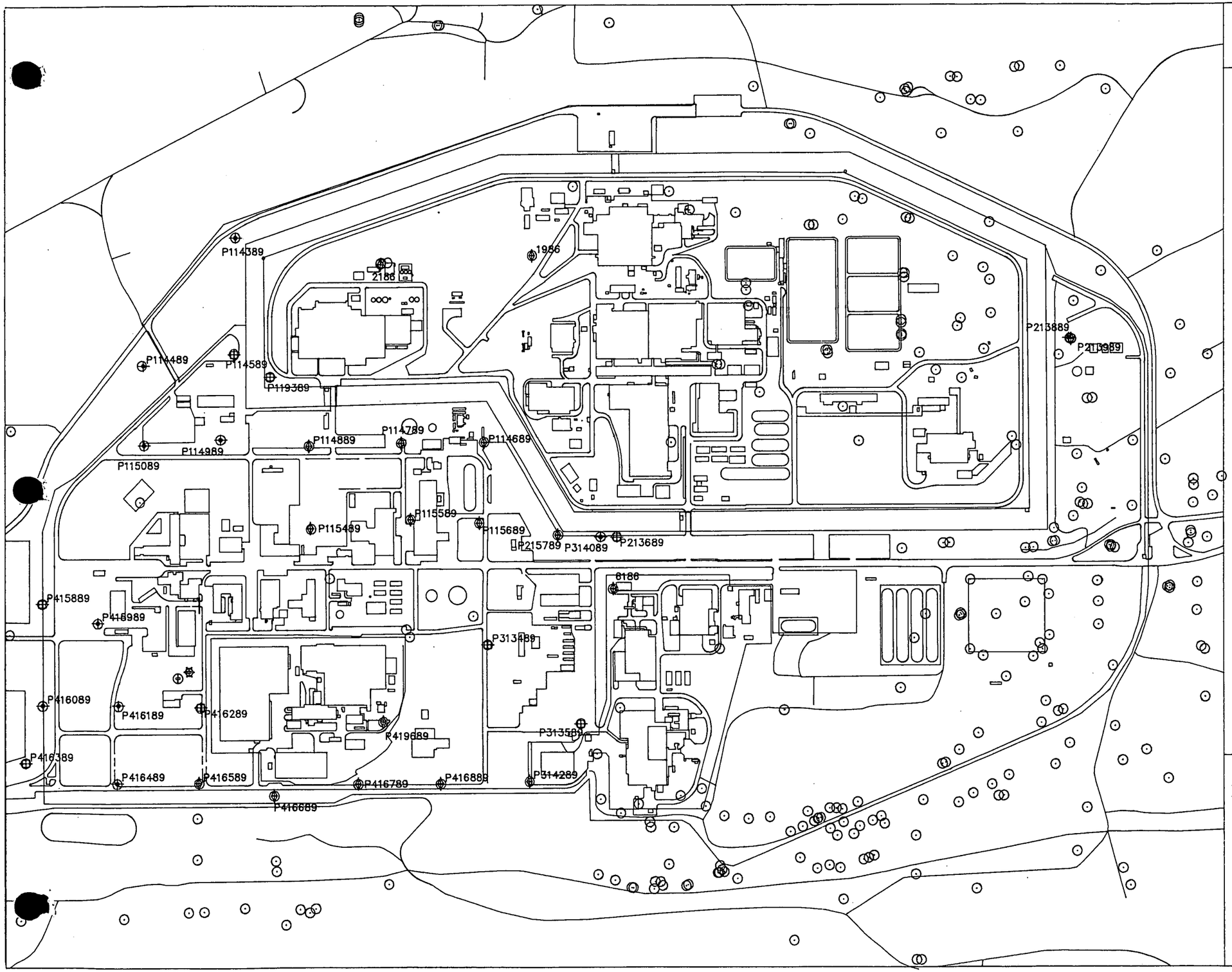
200 100 0 200 400 feet

FIGURE 4–4
INDUSTRIAL AREA IM/IRA/DD

Groundwater Analytical Results
Fourth Quarter 1993

EG&G ROCKY FLATS
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402–0464

(intentionally blank)



U.S. Department of Energy
Rocky Flats Plant

EXPLANATION

- Existing Alluvial Well
- Existing Bedrock Well
- Building
- Fence
- Dirt Road
- Paved Road
- Existing Well Recommended for IA IM/IRA Sampling
- Existing Well Tentatively Recommended for Sampling
- Well Not Recommended for IA IM/IRA Sampling

N

200 100 0 200 400 feet

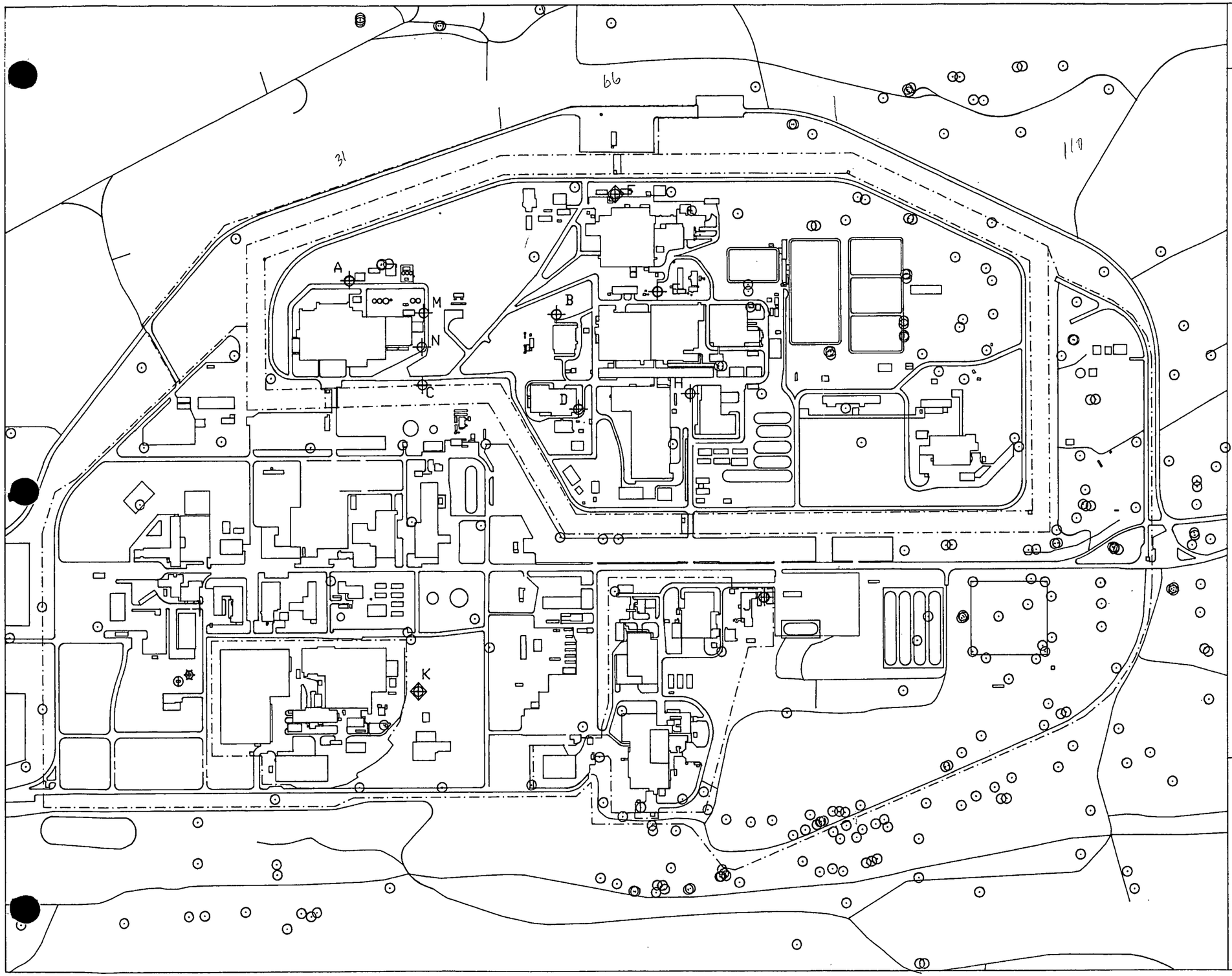
FIGURE 4–5
INDUSTRIAL AREA IM/IRA/DD

Existing Monitoring Wells Recommended for IM/IRA Monitoring Program

EG&G ROCKY FLATS
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402–0464

c:\rflats\sw\swfig45.dwg 05H60300

(intentionally blank)



U.S. Department of Energy

Rocky Flats Plant

EXPLANATION

- Recommended Monitoring Well (Bedrock)
- G Recommended Monitoring Well (Alluvium)
- Existing Alluvial Well
- Existing Bedrock Well
- Building
- Fence
- Dirt Road
- Paved Road

N

200 100 0 200 400 feet

FIGURE 4–6
INDUSTRIAL AREA IM/IRA/DD

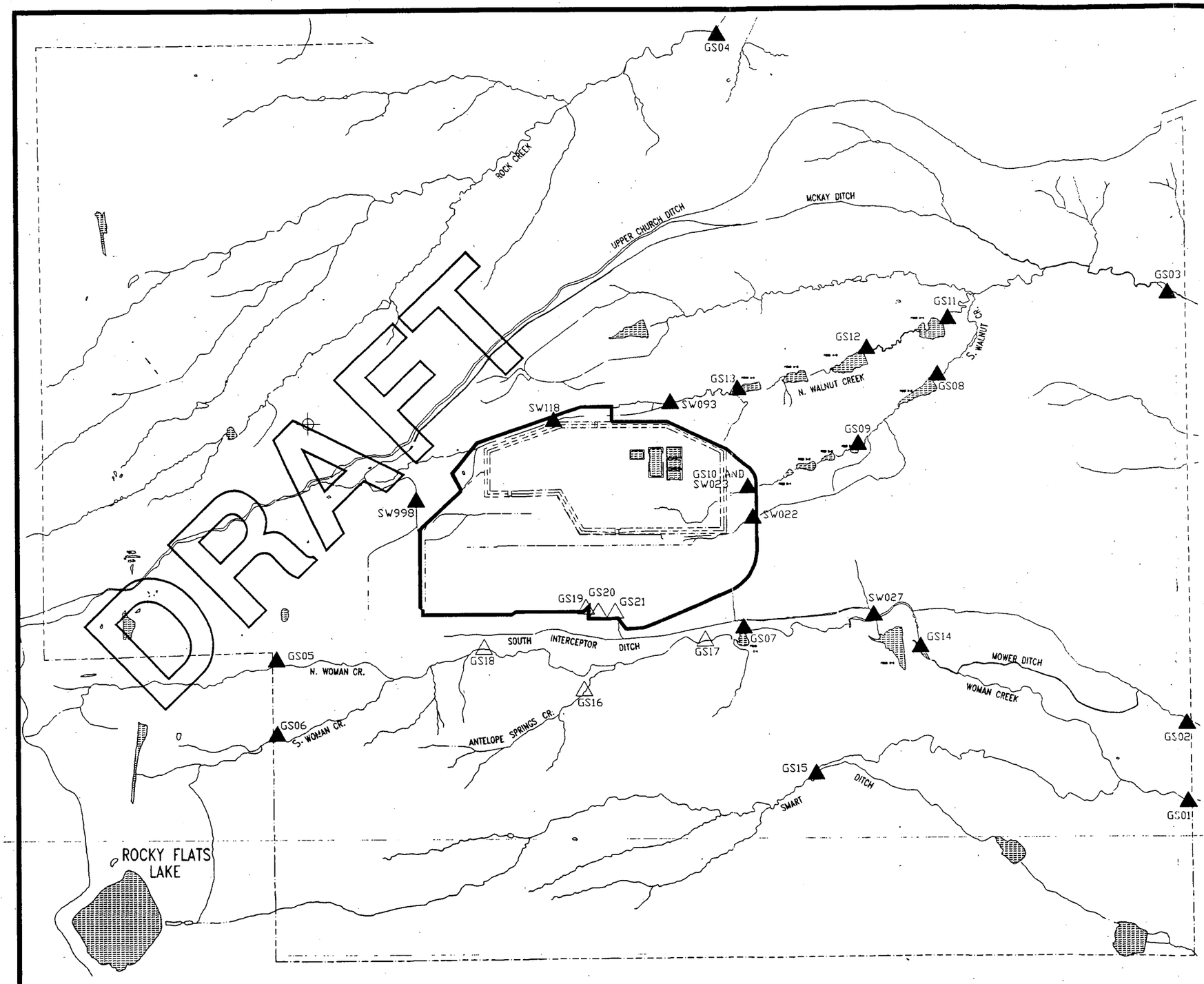
Recommended Monitoring Well Locations

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402–0464

c:\rflats\sw\swfig46.dwg 05H60300

(intentionally blank)



LEGEND

- ▲ GAGING AND SAMPLING STATIONS : Aug 1993
- △ STATIONS ADDED IN 1993
- ----- SECURITY FENCE
- ---- STREAMS, DITCHES, DRAINAGE FEATURES
- ━━━ INDUSTRIAL AREA
- ⊕ 61 METER METEOROLOGIC TOWER

N

FEET

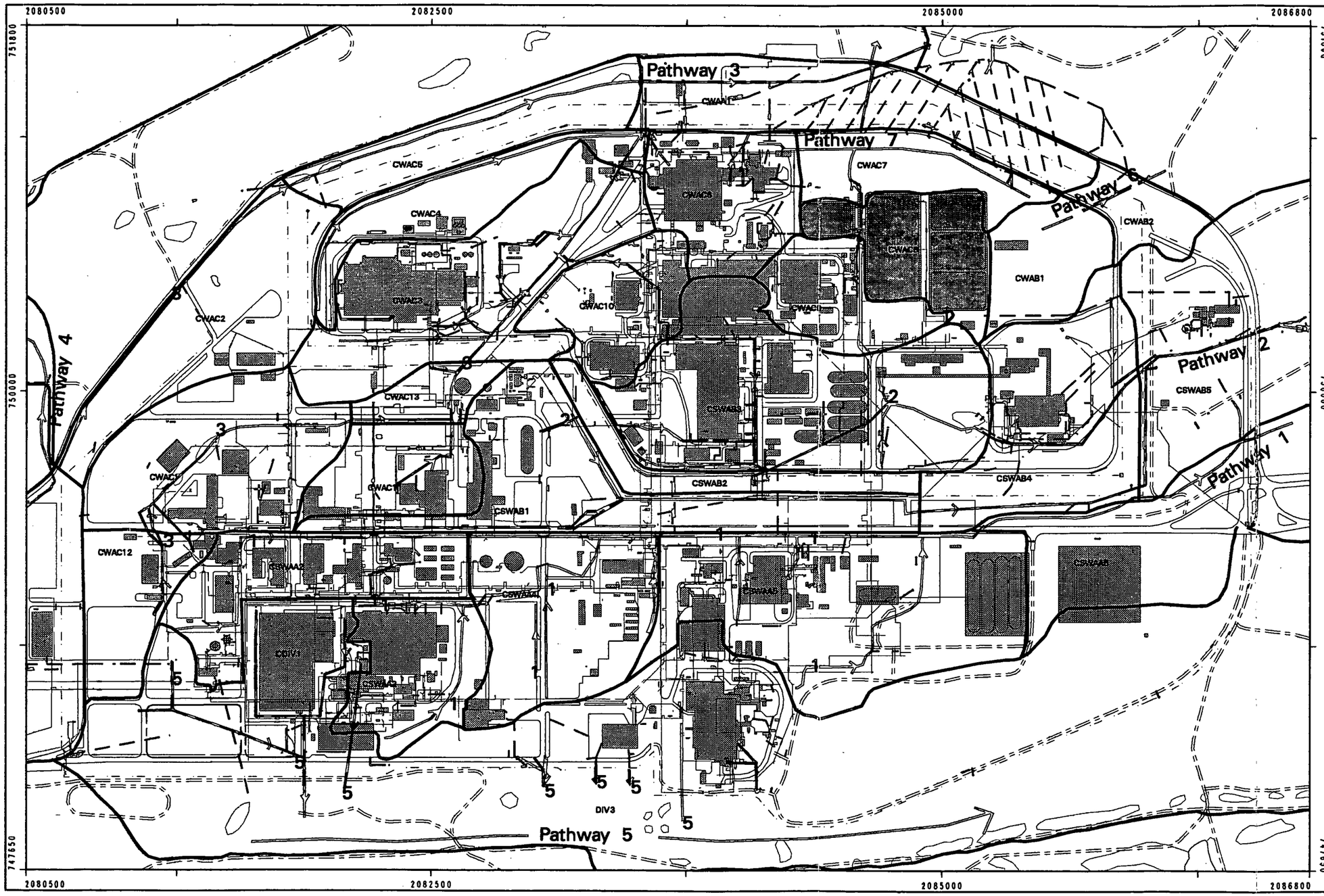
0 1750 3500

PREPARED FOR:
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS PLANT
GOLDEN, COLORADO

TITLE:
FIGURE 5-1
ROCKY FLATS PLANT
GAGING STATIONS AND STORM WATER MONITORING LOCATIONS

PROJ. NO.	901-004.450	DWG. NO.		SHEET
DESIGN BY		CHECKED		
DRAWN BY	WSA	APPROVED		OF
DATE		SCALE		

(intentionally blank)



U.S. Department of Energy
Rocky Flats Plant
Figure 5-2

INDUSTRIAL AREA IM/IRA/DD
Drainage Subbasins and Flow Pathways

- *Buildings*
- *Hydrologic Features*
- *Paved roads*
- *Dirt roads*
- *Water lines*
- *Storm Drain System*
- *Wetlands*
- *Drainage Subbasin*
- *Overland Flow Pathways*

CSWAB4-Subbasin Number

Scale = 1 : 8000
1 Inch = 600 feet

0 600

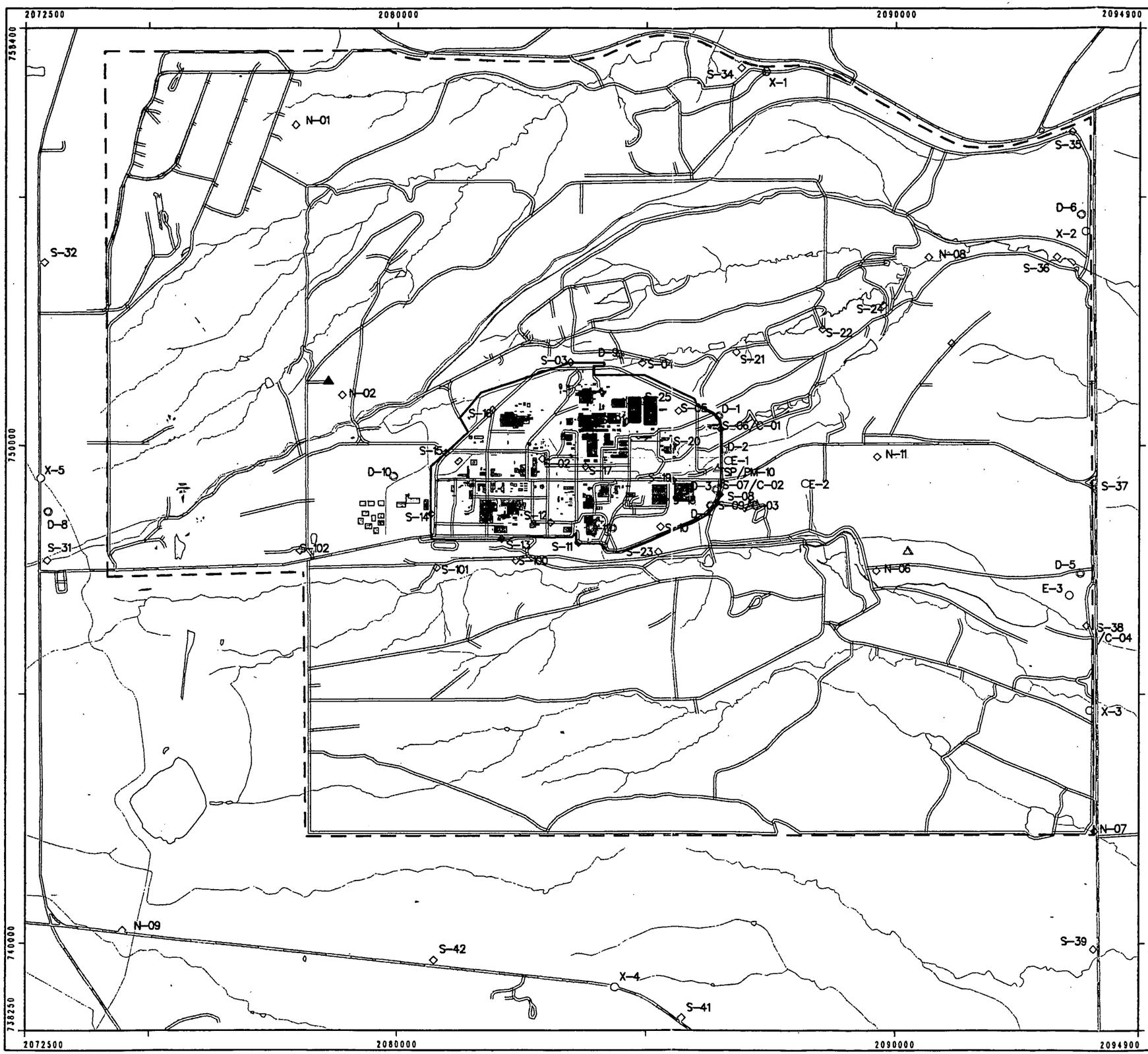
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

Prepared by:
EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

Date: March 04, 1994

(intentionally blank)



U.S. Department of Energy

Rocky Flats Plant

Figure 6-1

Industrial Area IM/IRA/DD Air Sampling Stations

- *Buildings*
- *Lakes and Ponds*
- *Major roads*
- *Paved roads*
- *Dirt roads*
- *Fences*
- *Rocky Flats Plant Boundary*
- ▲ *61 Meter Meteorological Tower*
- △ *Proposed Meteorological Tower*
- △ *RFP TSP/PM-10 Sampler*
- ○ *CDH Air Samplers D,E = Particulate and Radiological Ambient Air Sampling Stations X = VOC, NOx, particulate, radionuclide and metals sampling stations*
- ◇ *RFP Radiological Ambient Air Sampling Stations*

N

Scale = 1 : 24000
1 inch = 2000 feet

0 3800

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

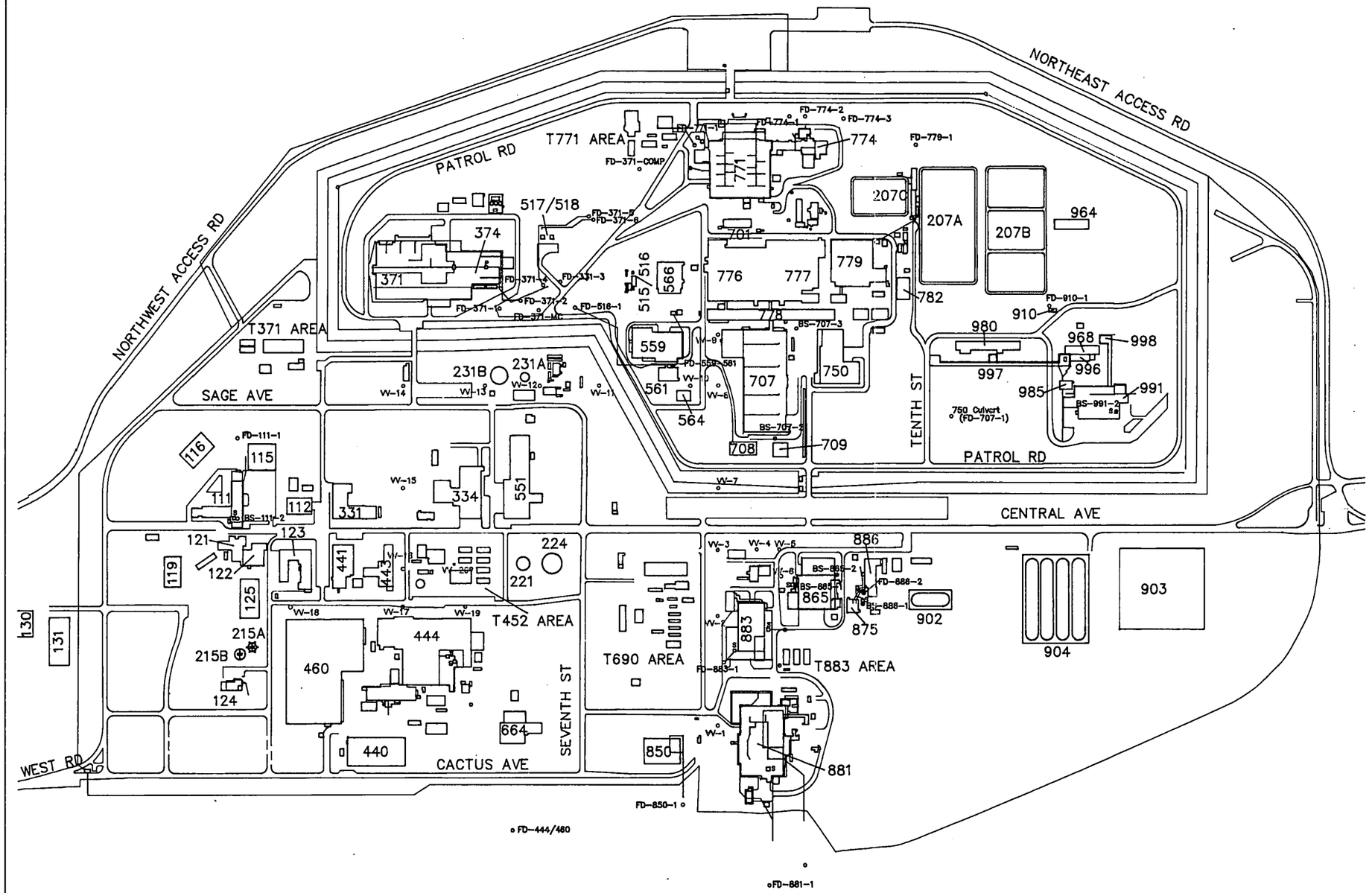
Prepared by:

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

Date: March 09, 1994

(intentionally blank)



U.S. Department of Energy

Rocky Flats Plant

DRAFT

- Valve Vault
- Outfall/Sample Location
- Foundation Drain
- Road
- Fence
- Structure/Building
- Sump/Pit
- FD Foundation Drain
- BS Building Sump

N

100 300 500
0 200 400 FEET

FIGURE 7-1
INDUSTRIAL AREA IM/IRA/DD

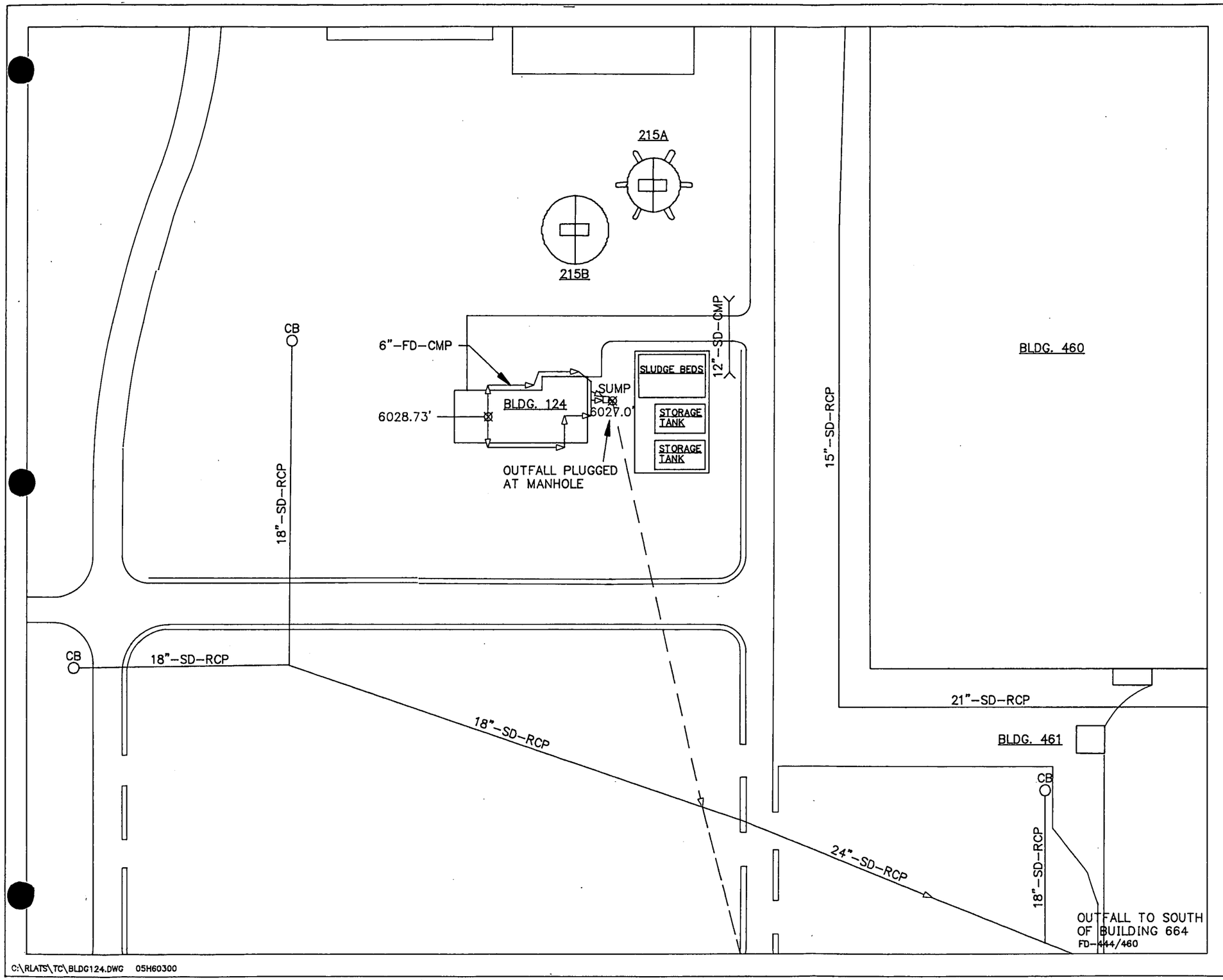
Foundation Drains, Building Sumps, Valve Vaults, and Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

C:\RFLATS\TC\MAP8-1.DWG 05H60300

(intentionally blank)



U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- Original Drain Location
- FD Foundation Drain
- SD Storm Drain
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- RCP Reinforced Concrete Pipe
- CB Catch Basin
- Roads
- Elevation
- Outfall

-N-

0 FEET 70

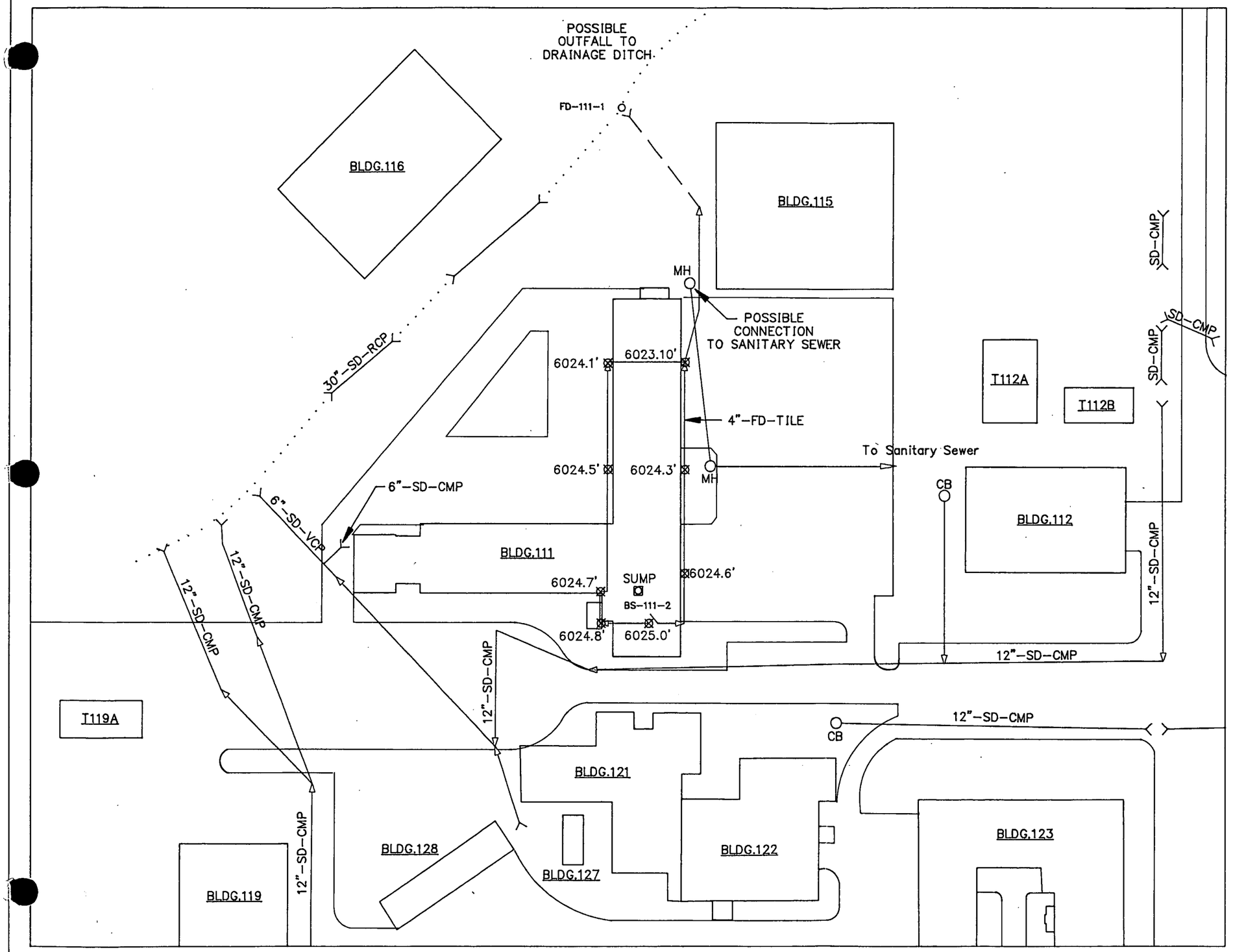
FIGURE A-2
INDUSTRIAL AREA IM/IRA/DD

Building 124
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

(intentionally blank)



U.S. Department of Energy

Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- Suspected Storm Drain
- FD Foundation Drain
- SD Storm Drain
- BS Building Sump
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- RCP Reinforced Concrete Pipe
- CB Catch Basin
- MH Manhole
- Roads
- Ditch
- Elevation
- Outfall

-N-

0 FEET 70

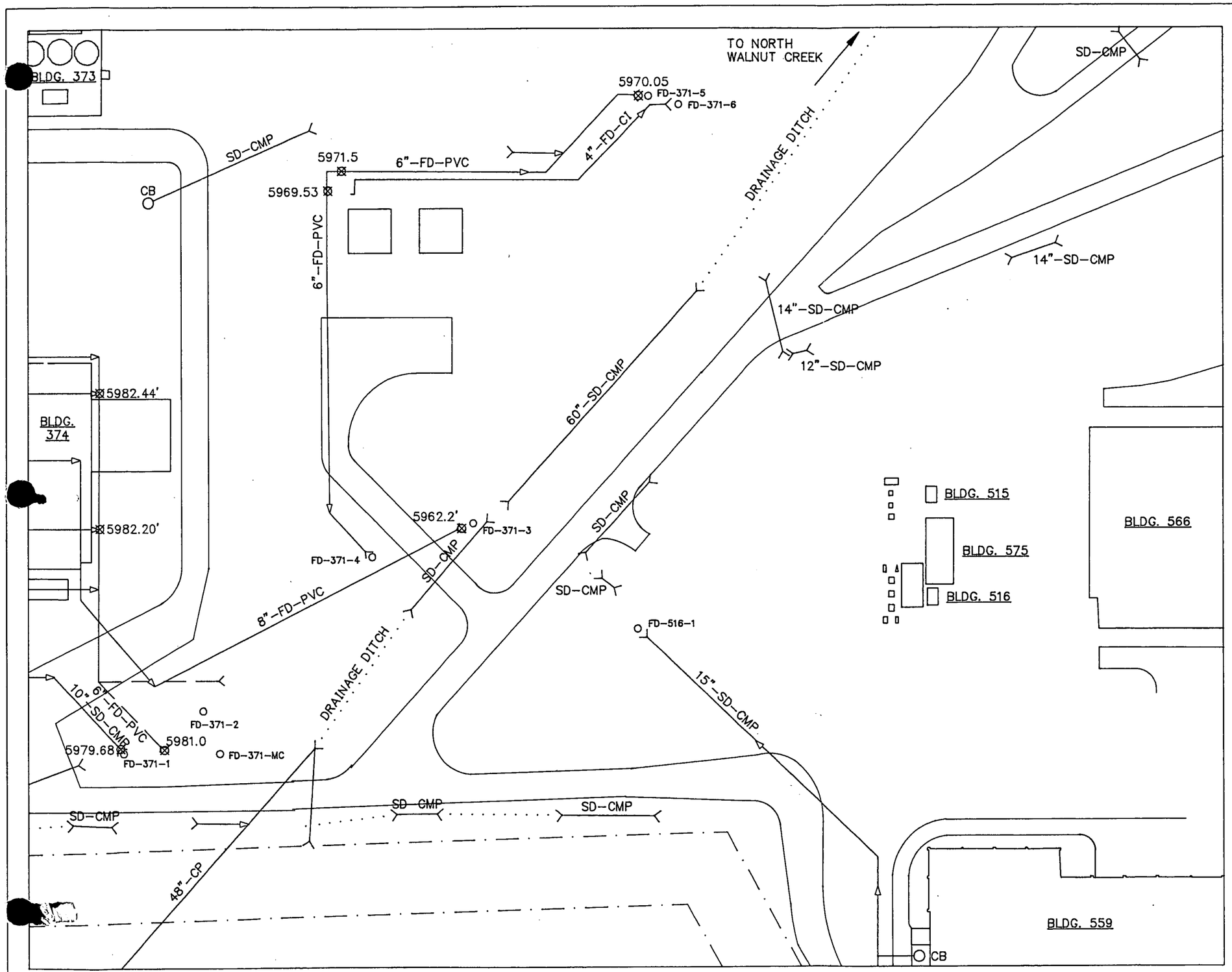
FIGURE A-1
INDUSTRIAL AREA IM/IRA/DD

Building 111
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

(intentionally blank)



C:\RLATS\TC\BLDG575.DWG 05H60300

U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- Possible Foundation Drain

FD Foundation Drain
SD Storm Drain
VCP Vitrified Clay Pipe
CMP Corrugated Metal Pipe
DIP Ductile Iron Pipe
CP Concrete Pipe
PVC PVC Pipe
CI Cast Iron
CB Catch Basin

- Fence
- Roads
- Ditch
- Elevation
- Outfall

-N-

0 FEET 70

FIGURE A-4
INDUSTRIAL AREA IM/IRA/DD

Buildings 559, 561, and 374
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

(intentionally blank)

U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- FD Foundation Drain
- SD Storm Drain
- Possible Foundation Drain
- FD Foundation Drain
- SD Storm Drain
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- PVC PVC Pipe
- PC Porous Concrete
- CP Concrete Pipe
- CB Catch Basin
- Fence
- Roads
- Ditch
- Elevation
- Outfall

0 FEET 70

FIGURE A-3
INDUSTRIAL AREA IM/IRA/DD

Building 371
Foundation Drain Outfalls

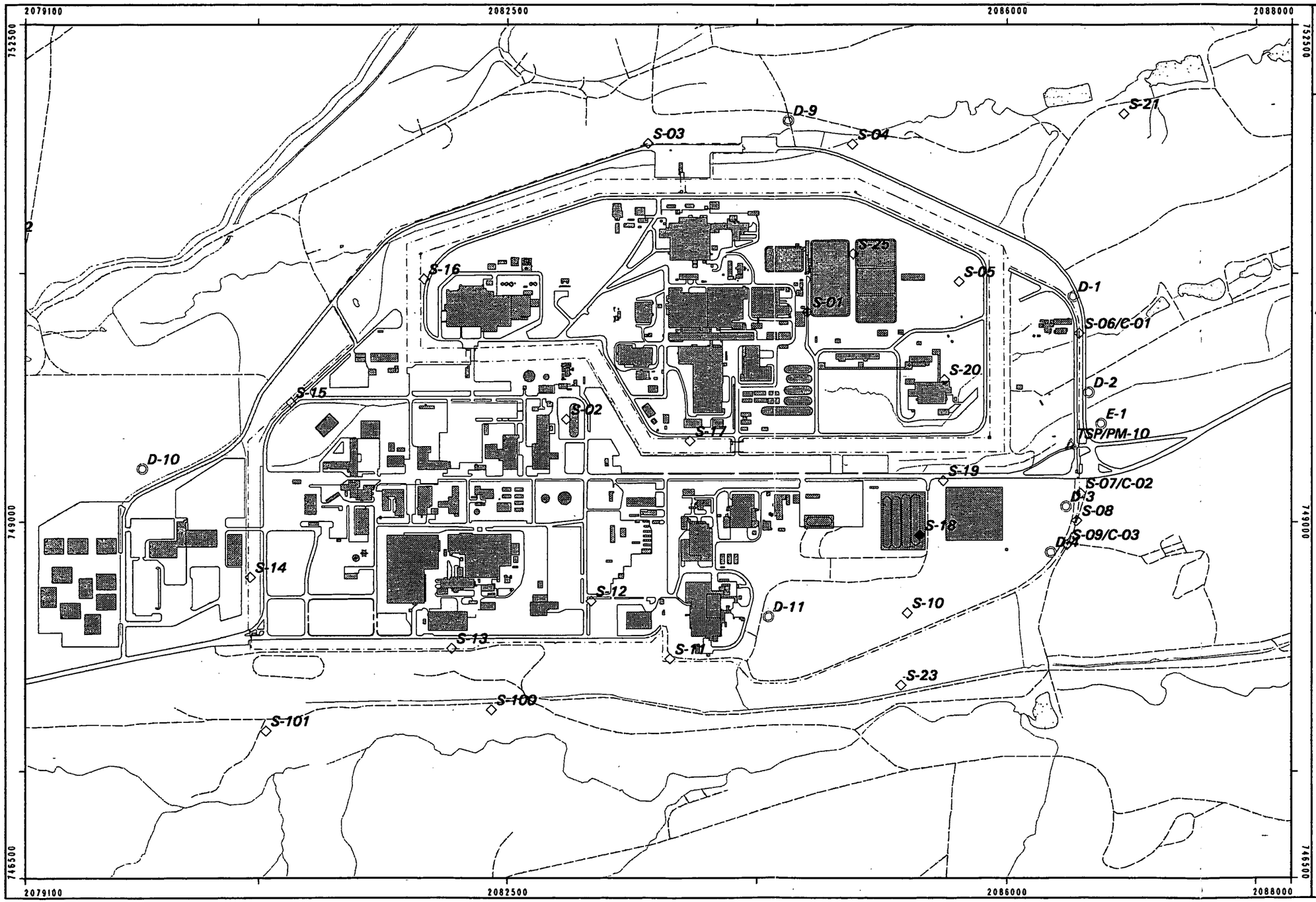
EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

T371J
T371H
BLDG. 376
BLDG. 373
BLDG. 381
BLDG. 371
BLDG. 374
PIT
SD-CMP
18"-SD-CMP
CB
5971.5
5969.53
OUTFALL TO DITCH
6"-FD-PVC
5984.36'
5984.18'
5984.0'
5983.83'
8"-FD-PC
5966.54'
10"-SD-CMP
5984.0'
5982.44'
5967.4'
5967.34'
5985.0'
6"-FD-PC
5966.1'
5966.33'
5968.04'
5984.8'
5967.4'
5984.0'
5982.20'
5967.04'
6"-FD-PC
5982.72'
OUTFALL TO HILLSIDE
FD-371-4
8"-FD-PVC
OUTFALL TO DITCH
DRAINAGE DITCH
5983.6'
8"-FD-PC
5982.89'
5984.64'
5983.99'
(ABANDONED IN PLACE)
10"-SD-CMP
10"-SD-CMP
6"-FD-PVC
FD-371-2
5981.0
FD-371-MC
5979.68
FD-371-1
SD-CMP
SD-CMP
SD-CMP
SD-CMP
SD-CMP
SD-CMP
48"-CP

\\RLATS\TC\BLDG371.DWG 05H60300

(intentionally blank)



U.S. Department of Energy

Rocky Flats Plant

Figure 6-2

Industrial Area IM/IRA/DD Air Sampling Stations

- *Buildings*
- *Lakes and Ponds*
- *Paved roads*
- *Dirt roads*
- *Fences*
- *RFP TSP/PM-10 Sampler*
- *CDH Air Samplers*
  D,E = Particulate and Radiological Ambient Air Sampling Stations
  X = VOC, NOx, particulate, radionuclide and metals sampling stations
- *RFP Radiological Ambient Air Sampling Stations*

Scale = 1 : 9400
1 inch = 700 feet

0 1000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

Prepared by:

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

(intentionally blank)

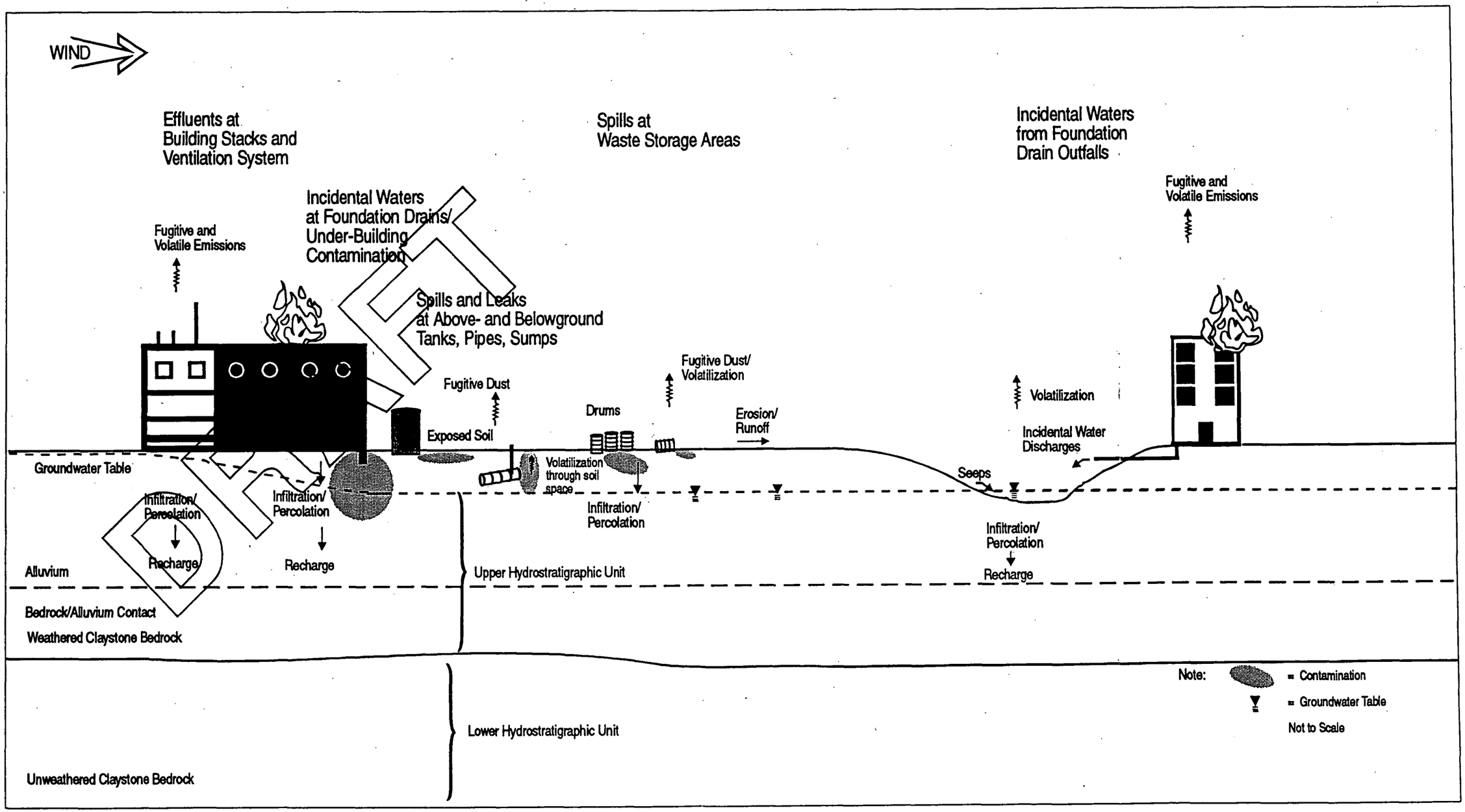


FIGURE 8-5
Industrial Area IM/IRA/DD
Conceptual Site Model - Unplanned Event Scenario

WP\FLATS\IM-IRA\FIG8-5.CDR

(intentionally blank)

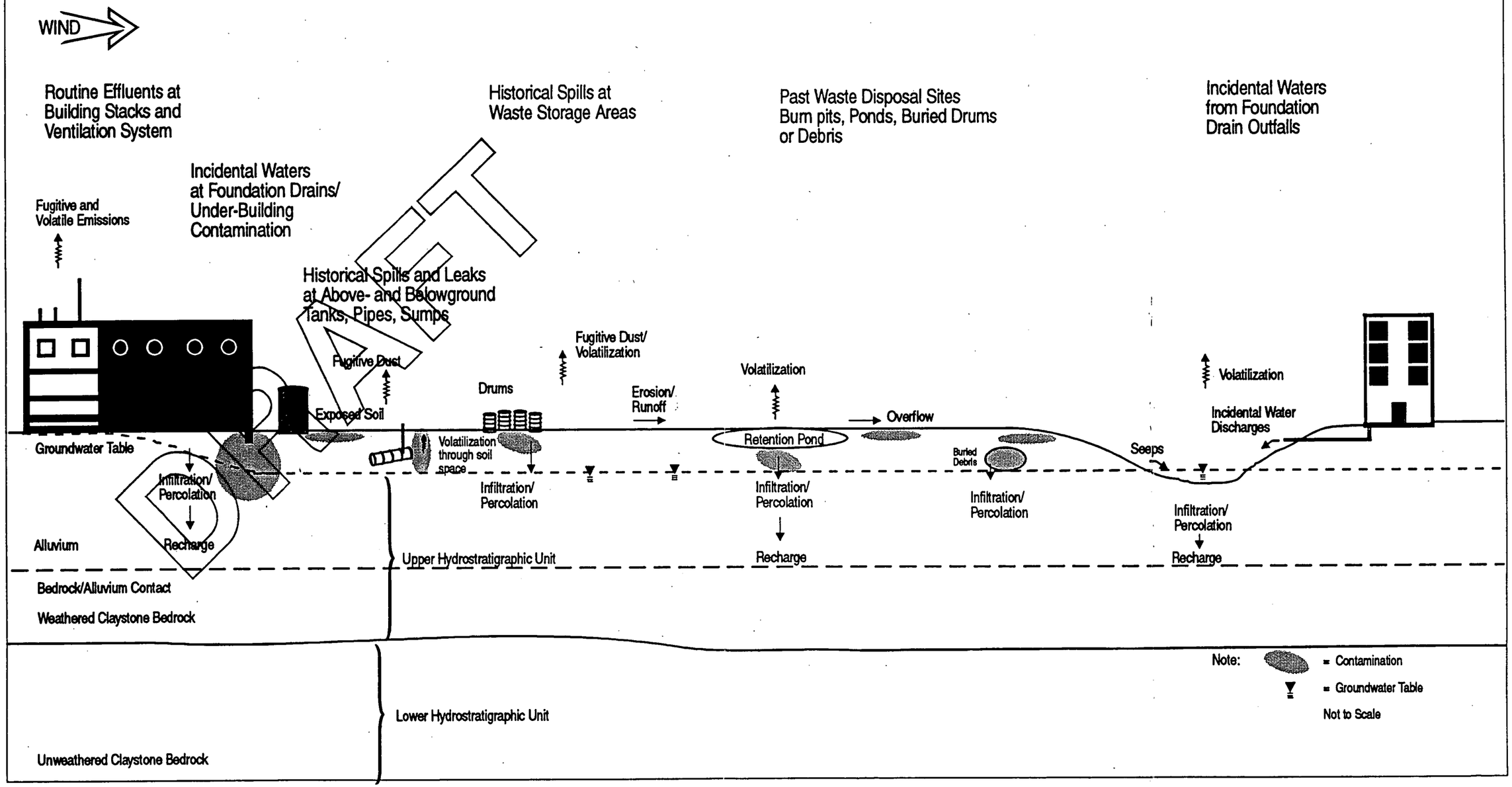
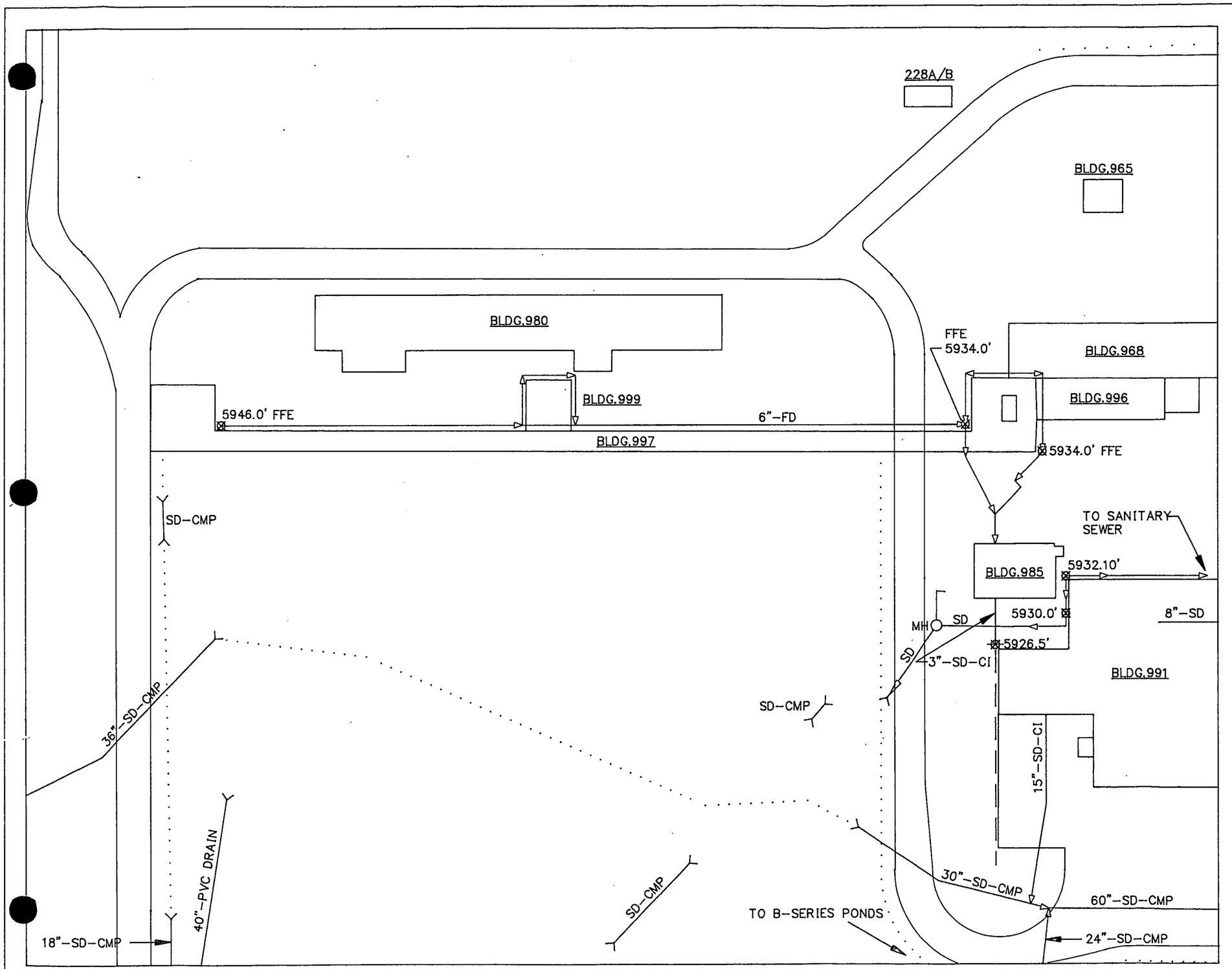


FIGURE 8-4
Industrial Area IM/IRA/DD
Conceptual Site Model - Current Scenario

(intentionally blank)



U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- FD Foundation Drain
- SD Storm Drain
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- PVC PVC Pipe
- CI Cast Iron
- FFE Finished Floor Elevation
- MH Manhole
- Roads
- Ditch
- Elevation
- Outfall

-N-

0 FEET 70

FIGURE A-13
INDUSTRIAL AREA IM/IRA/DD

Buildings 996, 997, and 999
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

(intentionally blank)

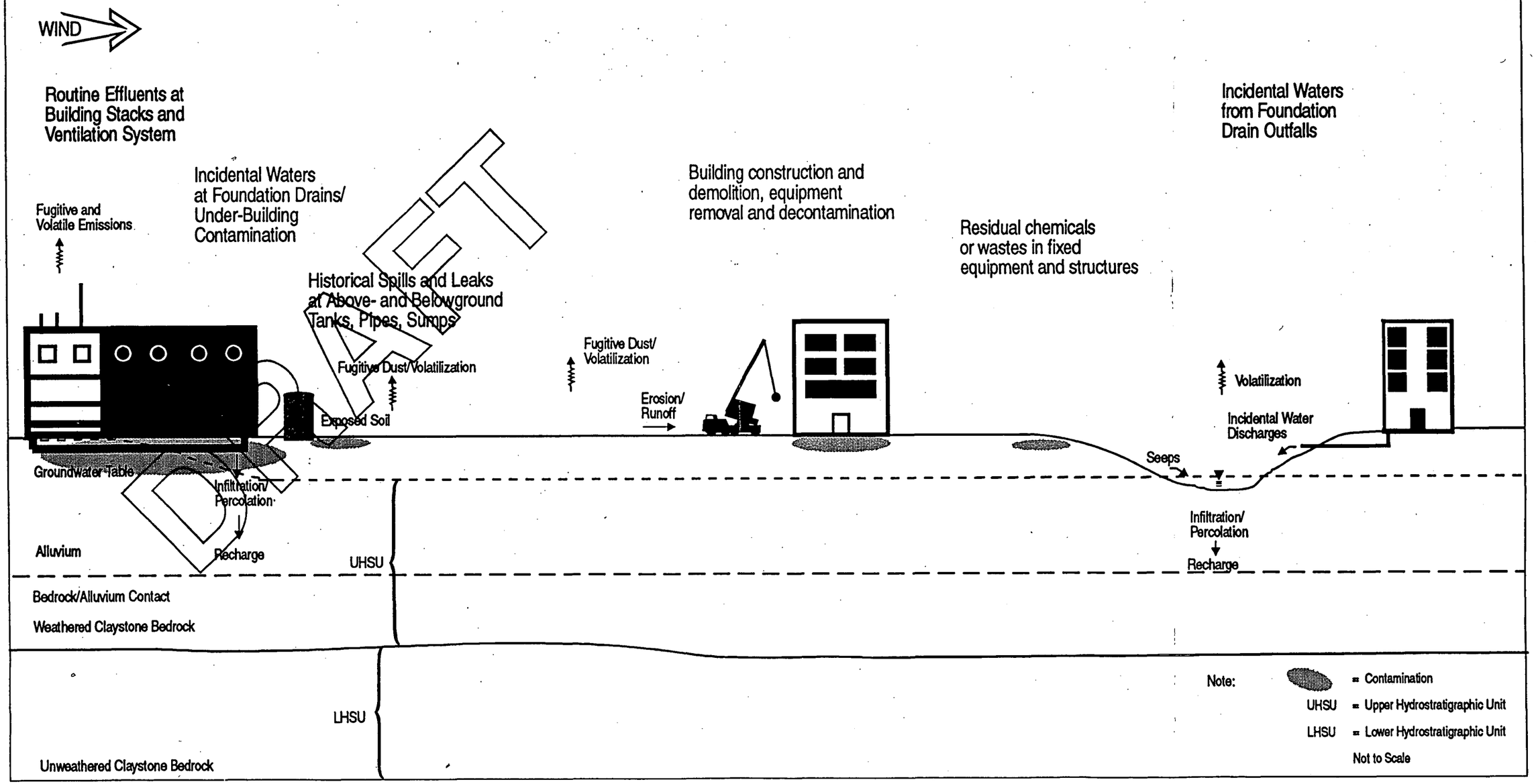


FIGURE 10-2
Industrial Area IM/IRA/DD
Future Conceptual Site Model

WP\FLATS\IM-IRA\FIG10-2.CDR

(intentionally blank)

U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- Old Foundation Drain
- FD Foundation Drain
- SD Storm Drain
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- SS Sanitary Sewer
- CI Cast Iron
- FFE Finished Floor Elevation
- Fence
- Roads
- Ditch
- Concrete Ditch
- Elevation
- Outfall

-N-

0 FEET 70

FIGURE A-14
INDUSTRIAL AREA IM/IRA/DD

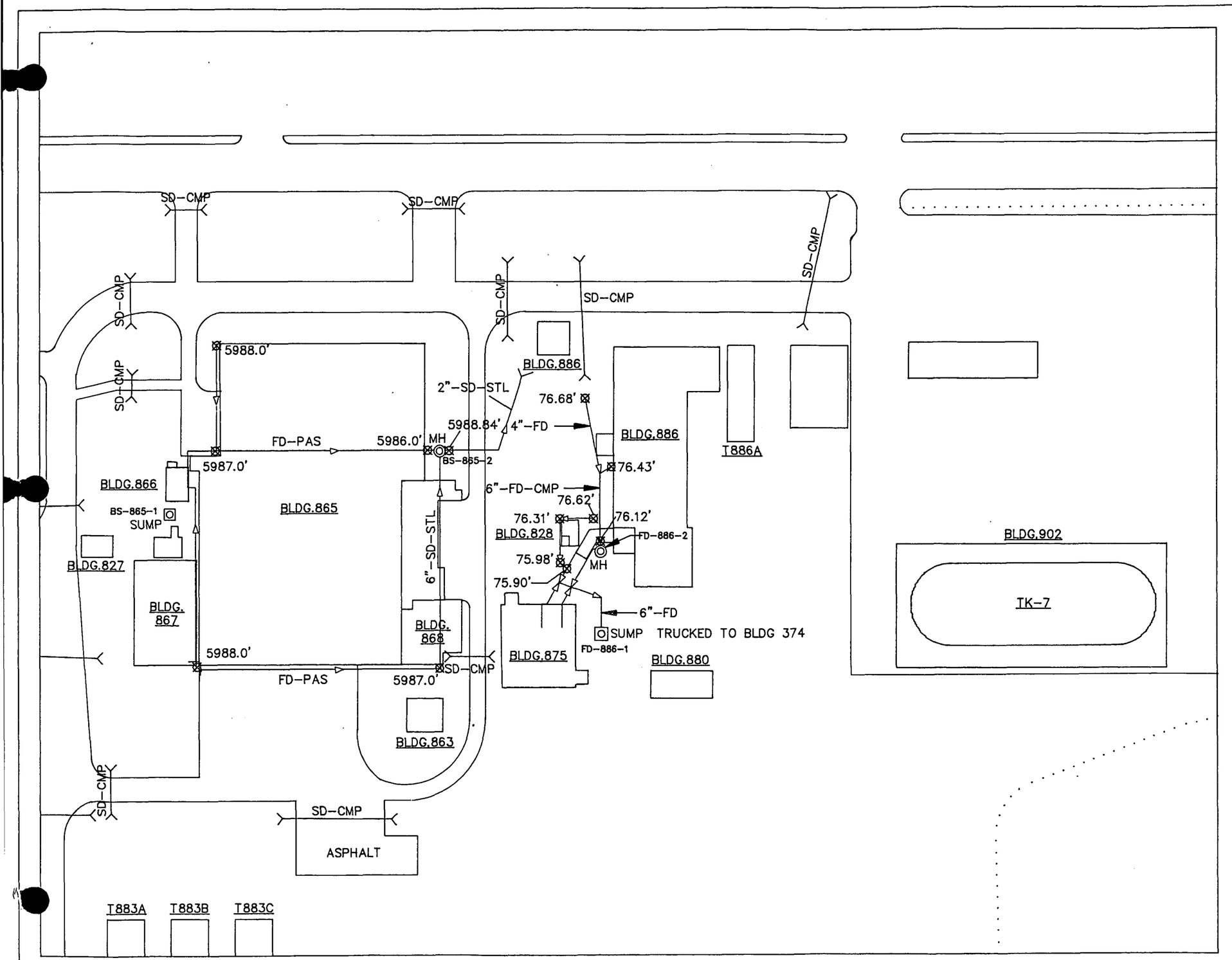
Buildings 998 and 991
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

C:\RLATS\TC\BLDG998.DWG 05H60300

(intentionally blank)



C:\RLATS\TC\BLDG886.DWG 05H60300

U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- FD Foundation Drain
- SD Storm Drain
- STL Steel
- PAS Perforated Asbestos Subdrain
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- MH Manhole
- BS Building Sump
- Fence
- Roads
- Ditch
- Elevation
- Outfall

-N-

0 FEET 70

FIGURE A-12
INDUSTRIAL AREA IM/IRA/DD

Buildings 875, 865, and 886
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

(intentionally blank)

U.S. Department of Energy

Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- Utility Tunnel Drain
- FD Foundation Drain
- SD Storm Drain
- BS Building Sump
- STL Steel
- PAS Perforated Asbestos Subdrain
- CMP Corrugated Metal Pipe
- CI Cast Iron
- PVC PVC Pipe
- GSP Galvanized Steel Pipe
- CB Catch Basin
- MH Manhole
- Roads
- Concrete Ditch
- Elevation
- Outfall

-N-

0 FEET 70

FIGURE A-11
INDUSTRIAL AREA IM/IRA/DD

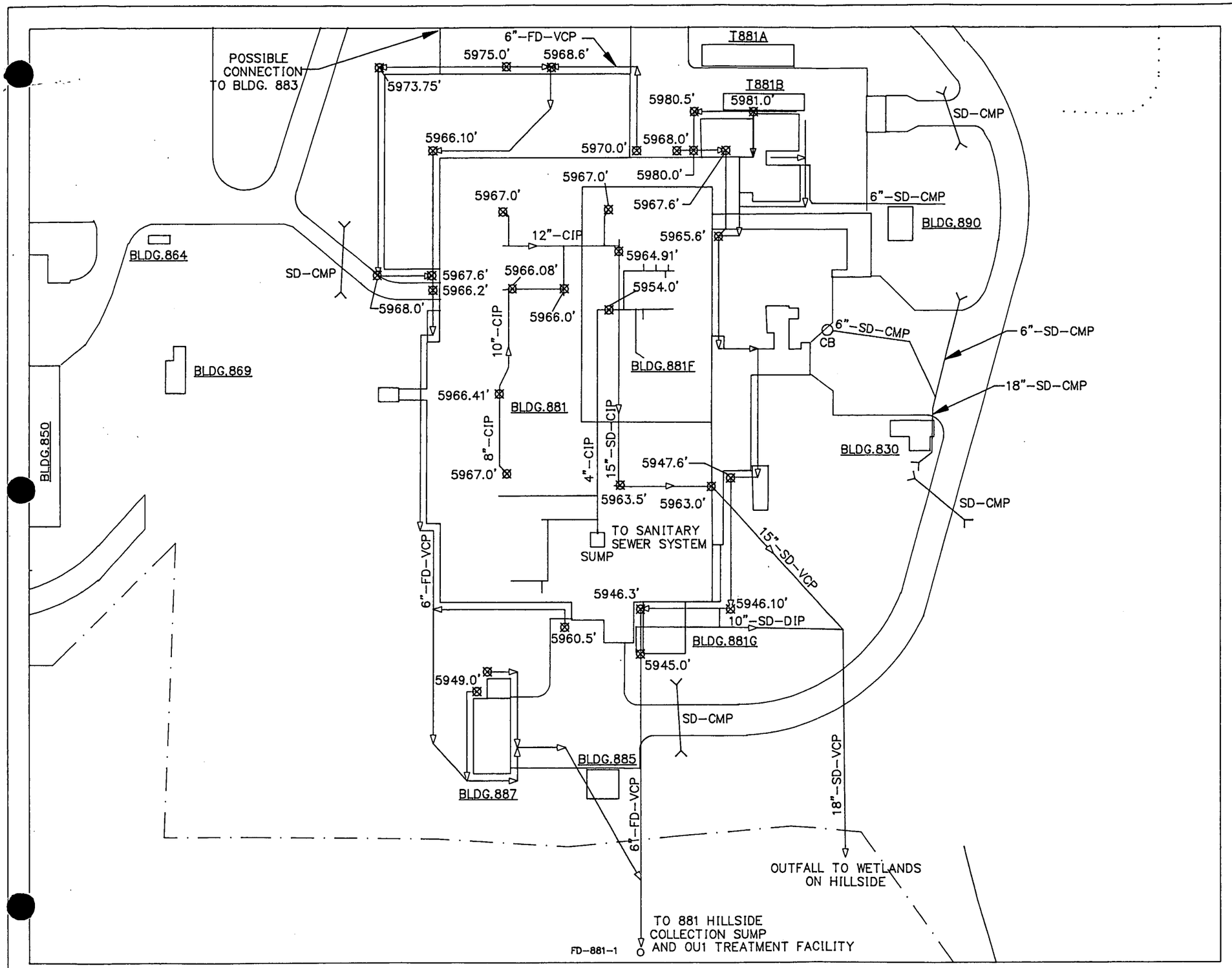
Building 883
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

C:\RLATS\TC\BLDG883.DWG 05H60300

(intentionally blank)



U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- Utility Tunnel
- FD Foundation Drain
- SD Storm Drain
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- CIP Cast Iron Pipe
- CB Catch Basin
- Fence
- Roads
- Ditch
- Elevation
- Outfall

-N-

0 FEET 70

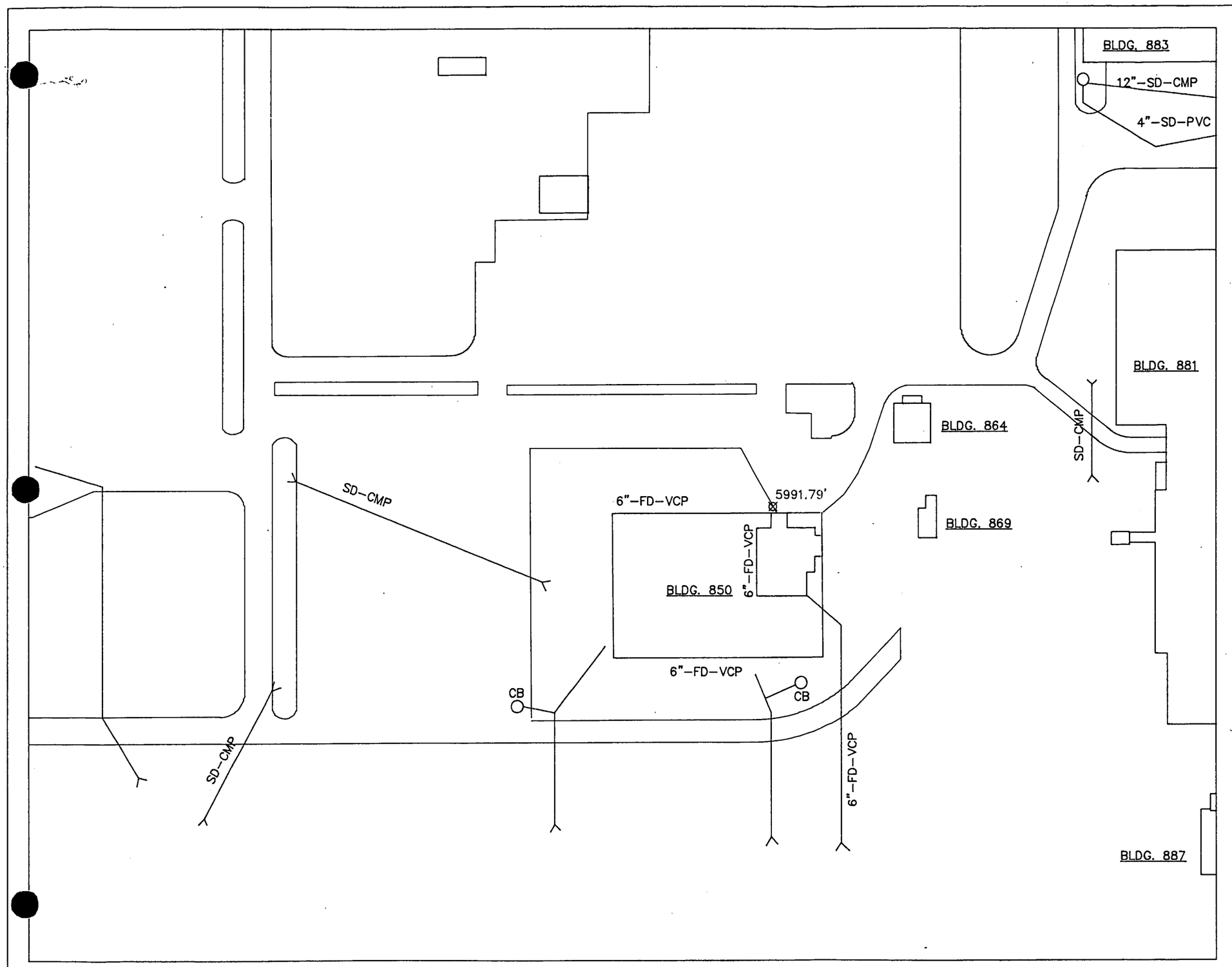
FIGURE A-10
INDUSTRIAL AREA IM/IRA/DD

Building 881
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

(intentionally blank)



U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- FD Foundation Drain
- SD Storm Drain
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- PVC PVC Pipe
- CB Catch Basin
- Roads
- Elevation
- Outfall

N

0 FEET 70

FIGURE A-9
INDUSTRIAL AREA IM/IRA/DD

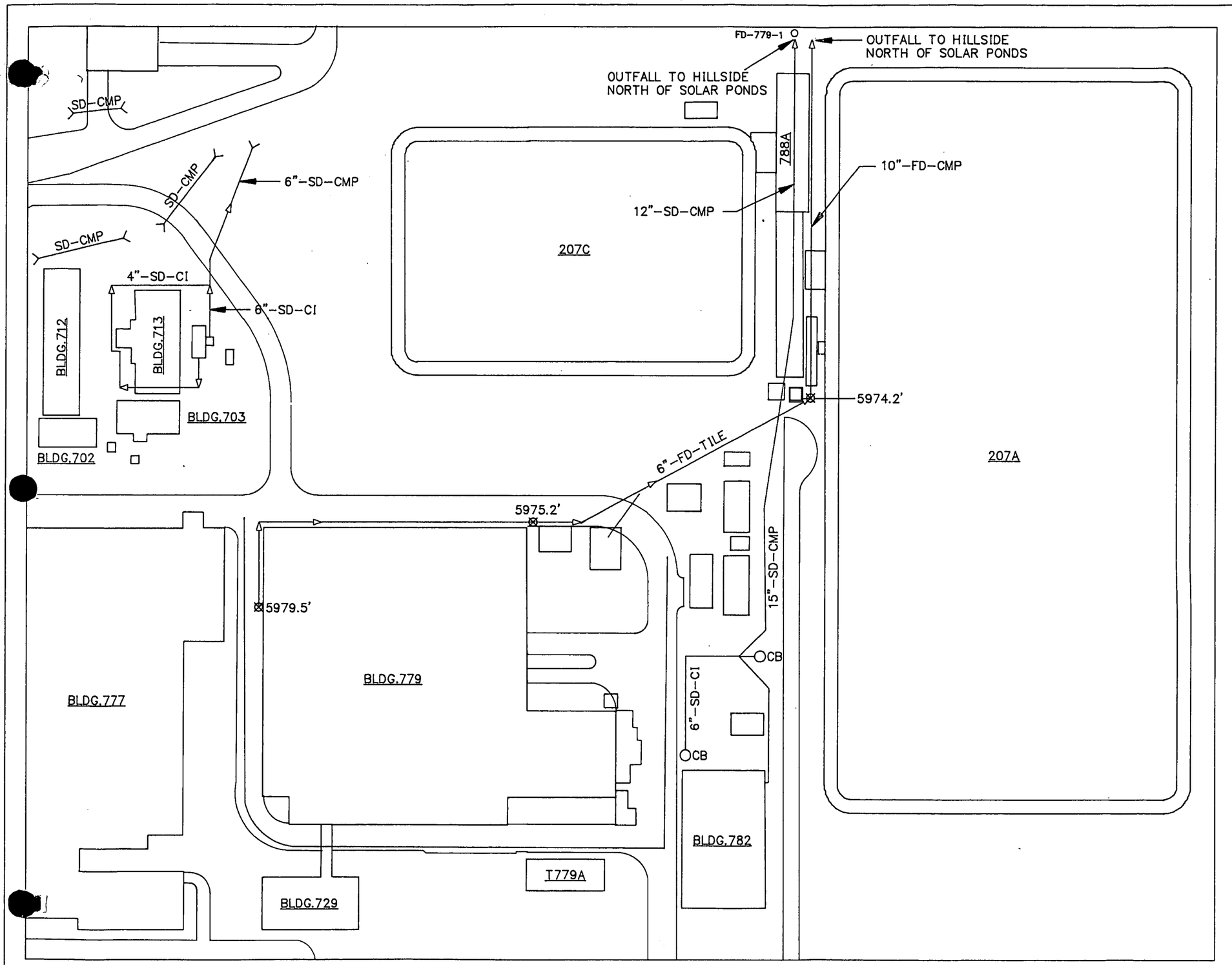
Building 850
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

C:\RFLATS\TC\BLDG850.DWG 05H60300

(intentionally blank)



C:\RLATS\TC\BLDG779.DWG 05H60300

U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- FD Foundation Drain
- SD Storm Drain
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- CI Cast Iron
- CB Catch Basin
- Roads
- Concrete Ditch
- Elevation
- Outfall

N

0 FEET 70

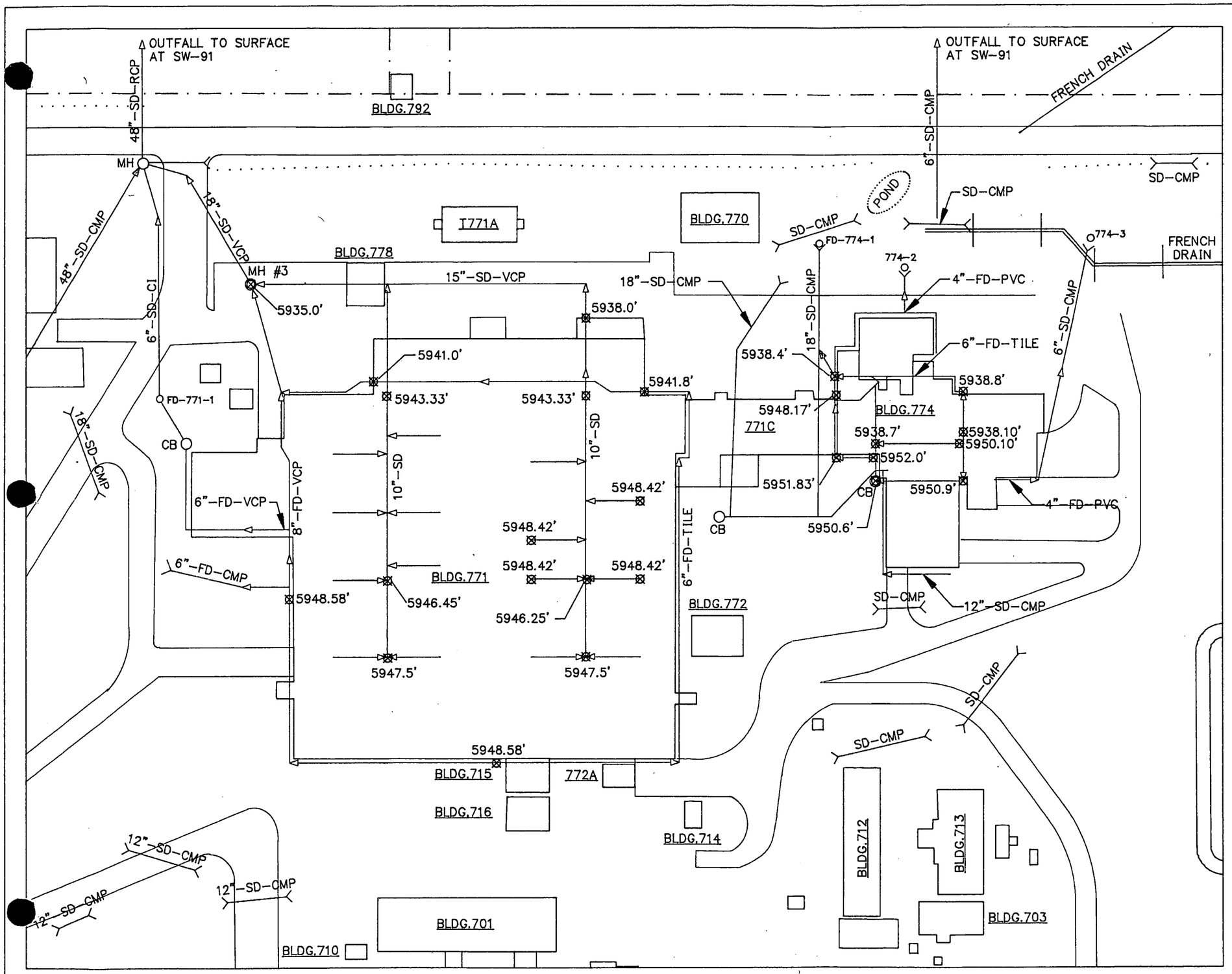
FIGURE A-8
INDUSTRIAL AREA IM/IRA/DD

Building 779
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

(intentionally blank)



U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- French Drain
- FD Foundation Drain
- SD Storm Drain
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- PVC PVC Pipe
- RCP Reinforced Concrete Pipe
- SW Surface Water Sample Point
- CI Cast Iron
- CB Catch Basin
- Fence
- Roads
- Ditch

N

0 FEET 70

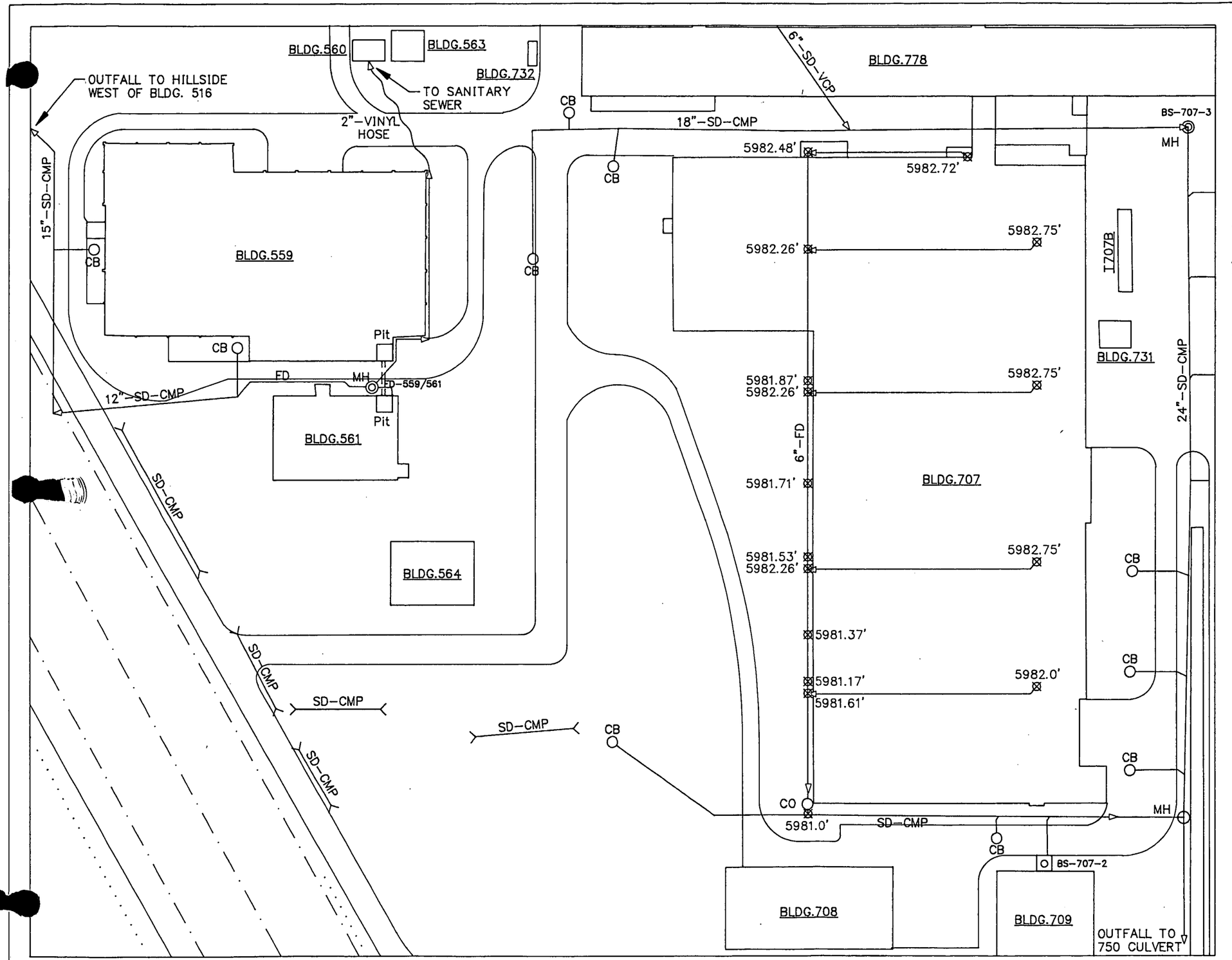
FIGURE A-7
INDUSTRIAL AREA IM/IRA/DD

Buildings 771 and 774
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

(intentionally blank)



C:\RLATS\TC\BLDG707.DWG 05H60300

U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- FD Foundation Drain
- SD Storm Drain
- BS Building Sump
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- CB Catch Basin
- MH Manhole
- CO Clean Out
- Fence
- Roads
- Ditch
- Elevation
- Outfall

FIGURE A-6
INDUSTRIAL AREA IM/IRA/DD

Buildings 559, 561, and 707
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

(intentionally blank)

U.S. Department of Energy
Rocky Flats Plant

DRAFT

- Buildings
- Foundation Drain
- Storm Drain
- FD Foundation Drain
- SD Storm Drain
- VCP Vitrified Clay Pipe
- CMP Corrugated Metal Pipe
- DIP Ductile Iron Pipe
- RCP Reinforced Concrete Pipe
- CB Catch Basin
- BOF Bottom of Footing
- Roads
- Ditch
- Elevation
- Outfall

-N-

0 FEET 70

FIGURE A-5
INDUSTRIAL AREA IM/IRA/DD

Buildings 444 and 447
Foundation Drain Outfalls

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

C:\RLATS\TC\BLDG447.DWG 05H60300

(intentionally blank)

U.S. Department of Energy

Rocky Flats Plant

PLATE 5-1

INDUSTRIAL AREA IM/IRA/DD

Surface Water Sampling Locations

- Surface water stations
- Routine operational sites
- NPDES/FFCA permit monitoring sites
- Gaging stations
- NPDES storm water permit sampling sites
- Paved roads
- Dirt roads
- Rocky Flats Plant boundary
- Streams, ditches, and other drainage features
- Ponds and lakes
- Buildings and other structures

Scale = 1 : 7200

1 inch = 600 feet

500 0 1000 2000ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

Prepared by:

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

Date: March 11, 1994